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ABSTRACT

This reference book and teacher's instructional guide are intended for use in one- and two-year food science and technology programs for Texas high school students. The reference book provides information needed by employees in the food science and technology occupational area. Each chapter includes the following components: (1) a list of the Texas Essential Knowledge and Skills that are discussed in the chapter; (2) a list of chapter vocabulary; (3) italicized, bold-faced vocabulary terms with definitions or explanations; (4) illustrations of equipment and procedures used in the industry today; (5) boxes posing "essential questions" about the materials presented; and (6) chapter highlights. A 13-item reference list and index are included. The following are among the items included in the teacher's guide: course description; list of facilities, equipment, and resources; guidelines for using the guide; list of pertinent Texas Essential Knowledge and Skills; block plans; 15 instructional strategies; supervised

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career connections experiences; blended activities; creative items; list of 85 resources; and 24 teaching aids. The program covers 18 topics in the following subject areas: careers in nutrition, food science, and food technology; nutrition, food science, and health; food technology; the world food supply; and food science, food technology, and the consumer. (MN)

Food Science and Technology.

Teacher's Instructional Guide [and] Reference Book.

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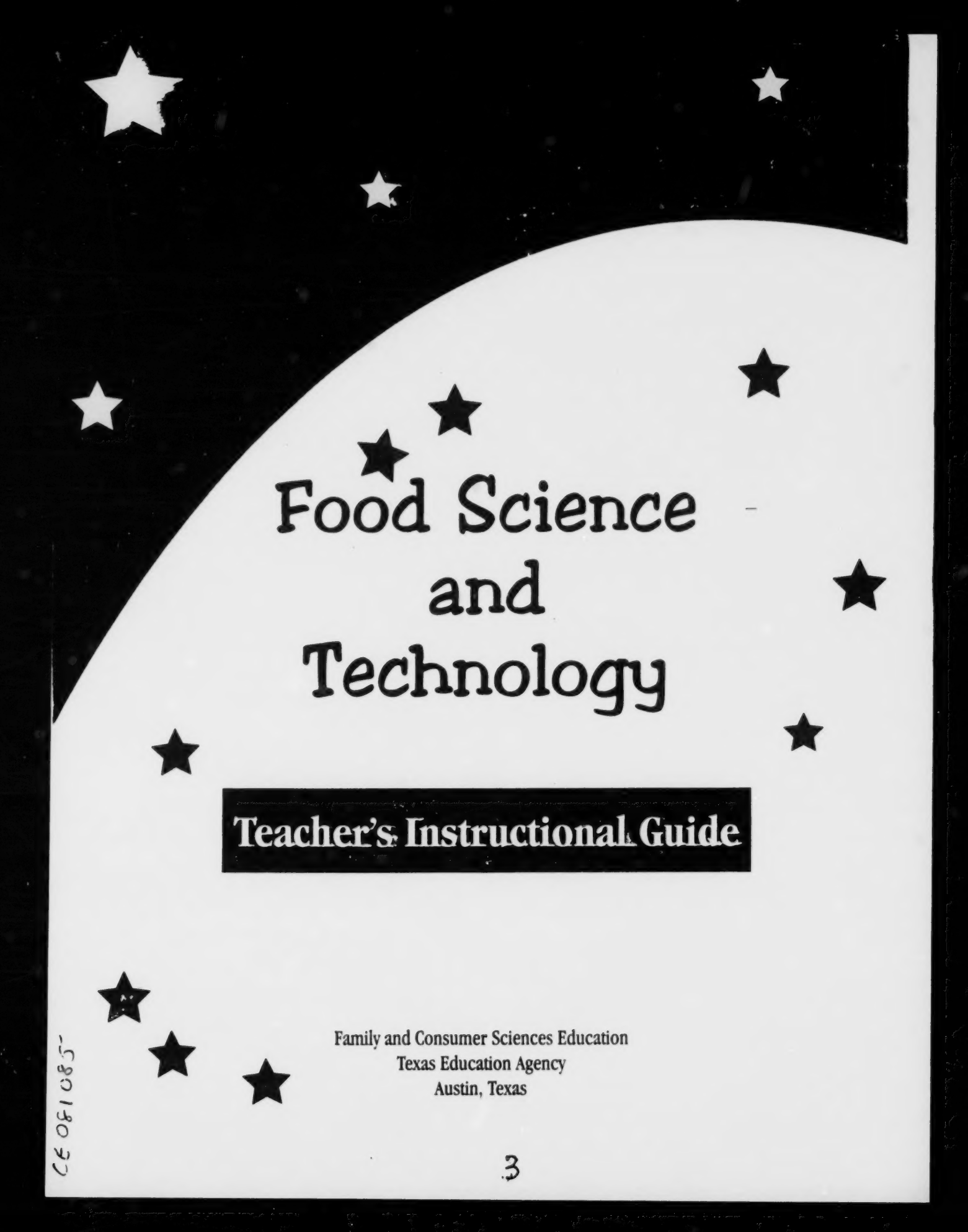
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Food Science and Technology

Teacher's Instructional Guide

Family and Consumer Sciences Education
Texas Education Agency
Austin, Texas

Food Science and Technology

Teacher's Instructional Guide

Developed and disseminated by:
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Course Description

Food Science and Technology (FDSCI&TK)

Recommended Grade Placement: 10-12

Recommended Prerequisite: Nutrition and Food Science

12204310

Credit: 1/2

This technical laboratory course provides foundation training in the area of food science and technology. Content addresses food science principles; nutrition and wellness; food technology; world food supply; managing multiple family, community, and career roles; and career options in nutrition, food science, and food technology. Instructional topics include diet-related disorders, diets appropriate to the life cycle and other factors, therapeutic diets, chemical and physical changes that affect food product quality, technologies used in food processing and product development, food safety and sanitation standards, market research, legal issues, and food policies. Laboratory activities utilizing research methods related to current issues in food science, technology, and nutrition are included.

Overview of Course Design

The process of developing the essential knowledge and skills focused on bringing all Family and Consumer Sciences content up-to-date in reflecting cultural, societal, demographic, economic, and technological changes. Further, in order to accommodate the content additions and redirections necessary to achieve relevance, constraints on instructional time forced dropping content that, while "nice to know" is not "absolutely essential" in today's society. Following are examples of these and other new directions/emphases not evident in the above description of this course:

Food Science and Technology:

- replaces the comparable Advanced Food Science and Nutrition course
- focuses on functions of nutrients in the body
- focuses on culturally diverse food choices that are nutritionally adequate
- focuses on application of science process skills in conducting laboratory activities
- focuses on using knowledge of digestion and metabolism to establish lifelong habits of good nutrition and physical fitness
- focuses on utilizing available technology to plan diets appropriate for long-term health and wellness
- focuses on how packaging affects the properties and quality of food and the environment
- focuses on functions of government agencies that regulate food quality, wholesomeness, and safety
- focuses on industry quality control standards and skills related to safety and safe working conditions
- focuses on the effects of technology on nutrition, the food supply, marketing, and distribution
- focuses on use of research skills in conducting and evaluating scientific research in food science
- focuses on the relationship of good health and nutrition to job performance and relationships
- focuses on the relationship of the food supply to quality of life
- focuses on the demands placed on food science and technology by American societal patterns
- focuses on prediction of possible solutions to problems of world hunger
- focuses on application of school-based learning in family, community, and career settings

Facilities, Equipment, and Resources

This technical course utilizes a state-of-the-art content laboratory arrangement that accommodates development of Food Science and Technology essential knowledge and skills through locally selected instructional strategies. Although textbooks previously used for the Food Science and Technology course are available, they are dated and inadequate. Utilization of a rich variety of up-to-date resources and technologies, including computers, software, and the information super highway, and a rich variety of hands-on laboratory experiences are critical for enriched instructional effectiveness, relevance, and retention.

Family, Career and Community Leaders of America

Family, Career and Community Leaders of America activities can be most effectively structured to serve as one of the many methods of instruction used in the classroom (i.e., independent study, group work, role play, questioning). As a method of instruction, activities of the organization reflecting specific family and consumer sciences content are incorporated into the Food Science and Technology course. Chapter activities need to be designed to accommodate chapter projects, community needs, and the desires of the students involved.

FCCLA activities are included as integral parts of instruction within several components of this instructional guide. Each instance is denoted by the FCCLA emblem in the margin.

- **Instructional Strategies** –FCCLA activities are written into the individual strategy when the project or program is an integral part of that specific learning experience.
- **Instructional Strategies** – Suggested FCCLA activities are provided in a box at the end of the numbered set of strategies to generate additional ideas for projects and programs that are relevant to the overall Texas Essential Knowledge and Skills (TEKS) statement, but not tied to a specific strategy.
- **Supervised Career-connections Experiences** – Throughout the course, FCCLA projects and programs are suggested that, depending on depth and extent, could constitute a supervised career-connections experience.
- **Blended Activities** – A separate page has been included in this section to provide ideas for FCCLA projects and programs that address multiple Texas Essential Knowledge and Skills.

As a method of instruction rather than the sole point of instruction, Family, Career and Community Leaders of America programs and projects will be present in instruction but not itemized in block plans. A chapter's organizational structure and the teacher's approach to utilizing the organization as a method of delivering course content will influence whether to have chapter activities once a week, once a month, or have some activity related to the content filtered into the curriculum on a more regular basis.

Resources available from the organization's national headquarters to assist with starting a chapter and integrating it into the curriculum are the *Co-Curricular Guide* and *FCCLA Handbook*. Additional national resources helpful to Food Science and Technology teachers and students include handbooks for the various national programs, such as *Student Body*, *Power of One*, *FCCLA Career Connection*, and *Leaders at Work*.

How to Use the Instructional Guide

You will be able to utilize the *Food Science and Technology Teacher's Instructional Guide* most effectively if you first understand all components and how they work together. Read through the Table of Contents and familiarize yourself with the various components of the instructional guide. Following are descriptions and suggestions for utilizing components within each section to maximize instructional effectiveness.

INTRODUCTION

Read the Introduction for information specific to the course on

- Course Description
- Overview of Course Design
- Facilities, Equipment, and Resources
- Family, Career and Community Leaders of America

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS (TEKS)

Familiarize yourself with the TEKS for Food Science and Technology. A copy of the Texas Administrative Code, Chapter 122.43, is provided in this document for your convenience.

The Texas Essential Knowledge and Skills are presented in a two-column format. In the left column are the numbered general knowledge and skills statements, [i.e., (1), (2), (3)]. In the right column are the related statements of expected student performance, sometimes referred to as knowledge and skills expectations [i.e., (A), (B), (C)]. Two pages have been allotted in the **Instructional Strategies** section for instructional strategies addressing each statement of expected student performance. Additional strategies that simultaneously address multiple statements of expected student performance are included in the **Supervised Career-connections Experiences** and **Blended Activities** sections of the instructional guide.

BLOCK PLANS

The block plans are included strictly as one example of how each course might be carried out in the available instructional time. It is intended that the block plans will serve only as an aid to teachers in planning instruction for the Texas Essential Knowledge and Skills for the course.

There will be many instances where time allotments as shown on the block plans will vary from time allotments as planned in your classroom. Factors impacting actual allotment include class size, length of class period, the school calendar, and local district policies. Also, time allotment will vary according to selected instructional strategies and the degree of emphasis placed on specific strategies and TEKS.

Local districts are encouraged to use the blank block forms found in this section to customize plans to accommodate other scheduling arrangements or to otherwise meet individual needs.

INSTRUCTIONAL STRATEGIES

Several instructional strategies are provided for each statement of expected student performance. It is not expected that you would use all strategies, but that you would select from the options those that best meet the needs of your students.

One of your greatest challenges in teaching the new TEKS is that of providing students with updated content information. Information changes so rapidly, and sources of information are so varied, that it is inappropriate and virtually impossible for the instructional guide to narrowly define much of the actual content. While some instructional strategies have built in obvious sources of information input, it is important for you to consciously seek and provide sources of information for each knowledge and skills expectation. The *Teacher's Instructional Guide* provides direction for resources and some background information sheets for both student and teacher use. Keeping abreast of content information can be accomplished through professional development, curriculum resources, professional organizations, and personal study. It is vital for all teachers continually to bring course content up-to-date.

The most important consideration is that students be enabled to meet each knowledge and skills expectation. Ask yourself continually, "How can I provide instruction so that students will know and be able to do what is expected?" As you analyze the student expectation provided in the shaded box at the top of each set of strategies, be sure to put that statement in the context of the general knowledge and skills statement.

For example, TEKS 1A states: The student is expected to describe the functions of nutrients in the body. Remember that TEKS 1A through 1D all fall under TEKS 1: The student relates nutritional adequacy to personal health.

To help you frame this important connection, fifteen divider pages have been inserted within the instructional strategies – one before each new numbered TEKS statement.

The **Instructional Strategies** section has been designed to teacher specifications – to facilitate ease of use and to provide as much needed information as possible. The following aids have been built into the format.

Notes Column

The Notes column on the outside of each page was designed to provide space for your own notes and to display information and icons that point out the following:

- where Teaching Aids provided in the guide have been used within the strategies
- strategies which correlate with exit level TAAS objectives and academic principles for reading, writing, mathematics, science, and social studies
- strategies that utilize technology applications
- opportunities for integration of FCCLA programs and projects within specific strategies

TA 1 *Tips for Teachers:
Laboratory Experiences
in Food Science and
Technology*

**TAAS
WRITING**



Strategy Headers

Each instructional strategy has been given a number and header designation so that you can easily locate and reference specific strategies and tell at a glance what general methodology is involved. In addition, the light bulb icon beside a header indicates that creative techniques related to the methodology are suggested in the **Creative Ideas** section.

Following are examples of headers used, with brief explanations or comments where titles may not be self-explanatory. The **Creative Ideas** section provides elaboration on many of these techniques.

- **AUDIOTAPE**
- **BRAINSTORMING** (see the Creative Ideas section)
- **CASE STUDY** (see the Creative Ideas section)
- **CLASS DISCUSSION**
- **DEBATE** (see the Creative Ideas section)
- **DEMONSTRATION**
- **EDUCATIONAL TOUR**
- **GAME** (see the Creative Ideas section)
- **GROUP ACTIVITY** (see the Creative Ideas section)
- **GUEST SPEAKER** (see the Creative Ideas section)
- **INDIVIDUAL ACTIVITY**
- **INTERNET SEARCH/ACTIVITY** (see the Creative Ideas section)
- **INTERVIEW**
- **LABORATORY EXPERIENCE**
- **OBSERVATION**
- **ORAL PRESENTATION** (see the Creative Ideas section)
- **PANEL DISCUSSION** (see the Creative Ideas section)
- **PROBLEM SOLVING**
- **PROJECT**
- **RESEARCH** – The header usually designates the systematic search for and collection of information about a particular subject, although some activities may involve more extensive research methods or more formal research projects.
- **ROLE PLAY**
- **SCENARIO** (see the Creative Ideas section)
- **SKIT**
- **SURVEY**
- **SYMPOSIUM** – In a symposium format, several persons present short, prepared speeches to a group on various aspects of a topic. Members of the group may ask questions after presentations are made. For example, three or four students research a particular topic and present information to the class; class members then dialogue with the presenters through questioning following the presentation.
- **TEAMWORK** (see the Creative Ideas section)
- **VIDEOTAPE** – Few videotapes are referenced by name other than those available from The Curriculum Center for Family and Consumer Sciences; these are suggested as samples because they have been previewed for content and appropriateness. Teachers are encouraged to utilize additional videotapes they have personally previewed for appropriateness.
- **VISUAL DISPLAY** (see the Creative Ideas section)
- **WRITTEN EXERCISE**

Resources

Space is provided at the end of each set of strategies for resources pertinent to each knowledge and skills expectation. Specific books, periodicals, agencies and organizations, videotapes, and Web sites are often listed, and space is provided for you to list additional resources.

A complete bibliography of all resources is provided under the tabbed divider, **Resources**.

SUPERVISED CAREER-CONNECTIONS EXPERIENCES

Examples of career-connections experiences for students enrolled in the Food Science and Technology course are provided. The "Note to the Teacher" on the introductory page to this section provides additional information about supervised career-connections experiences. Teaching Aid 78, **Activity Assessment**, has been provided as an example of an assessment tool for experiences such as these.

BLENDED ACTIVITIES

Blended activities are teaching and learning strategies that encompass several knowledge and skills expectations. These activities promote student learning of multiple TEKS simultaneously through hands-on, project-based, and/or problem-solving activities.

Blended activities provide extension and application of the basic knowledge and skills developed in strategies that address each individual student expectation. Some also serve as a means of authentic assessment. Teaching Aid 78, **Activity Assessment**, is also appropriate for many blended activities.

Included in the **Blended Activities** section are suggestions for FCCLA projects and programs that address multiple knowledge and skills expectations.

CREATIVE IDEAS

The rationale for this section, and guidelines for use, are provided on the section introductory page. Please read the **Creative Ideas** section! It provides many ideas for promoting active learning, as well as suggestions for saving teacher time and enhancing student learning and skills development.

TAAS OBJECTIVES AND PROFICIENCY

In response to teacher requests, a tabbed divider has been provided as a placeholder for filing updated TAAS objectives. This convenience, along with the icons for reading, writing, mathematics, science, and social studies in the Notes column of Instructional Strategy pages, will help you reinforce important academic concepts related to Food Science and Technology content.

RESOURCES

The resource section includes a bibliography of resource ideas generated by writers and reviewers of the document. Resources, which are listed alphabetically, include books, periodicals, agencies and organizations, videotapes, and Web sites.

A separate divider/section has been provided so you can add additional resources that you locate or obtain through professional development sessions.

TEACHING AIDS

In response to popular demand, teaching aids include transparency masters, student information sheets, activity sheets, assessment devices, and other tools to facilitate instruction (and save teacher development time!).

Chapter 122. Texas Essential Knowledge and Skills for Home Economics Education

Subchapter A. Home Economics Foundations, Middle School

Statutory Authority: The provisions of this Subchapter A issued under the Texas Education Code, §28.002, unless otherwise noted.

§122.1. Implementation of Texas Essential Knowledge and Skills for Home Economics Education, Home Economics Foundations, Middle School.

The provisions of this subchapter shall supersede §75.50(a) of this title (relating to Life Management Skills) beginning September 1, 1998.

Source: The provisions of this §122.1 adopted to be effective September 1, 1998, 22 TexReg 5031.

§122.43. Food Science and Technology (One-Half Credit).

- (a) General requirements. This technical laboratory course is recommended for students in Grades 10-12. The recommended prerequisite for this course is Nutrition and Food Science.
- (b) Introduction. Principles of food science, technology, and nutrition are interdependent with growth, development, health, and wellness. Individuals utilize these principles to make informed choices, promote good health, and pursue careers related to food science, technology, and nutrition.

(c) Knowledge and skills.

- (1) **Food science principles.** The student relates nutritional adequacy to personal health.

The student is expected to:

- (A) describe the functions of nutrients in the body;
- (B) analyze the relationship of nutrients and other factors to diet-related diseases and disorders;
- (C) relate cultural food patterns to personal health; and
- (D) analyze culturally diverse food choices that are nutritionally adequate.

- (2) **Food science principles.** The student analyzes ways to maximize quality nutrition.

The student is expected to:

- (A) determine various methods for retaining nutrients and improving nutrient content in foods; and
- (B) describe the impact of new technology on food science.

- (3) **Food science principles.** The student evaluates a variety of changes, including chemical and physical, that affect food product quality.

The student is expected to:

- (A) apply science process skills in conducting laboratory activities;
- (B) explain the chemical reactions that occur during food processing;

- (4) **Nutrition and health.** The student uses knowledge of digestion and metabolism to establish lifelong habits of good nutrition and physical fitness.

- (5) **Nutrition and health.** The student utilizes available technology to plan diets appropriate for long-term health and wellness.

- (6) **Nutrition and health.** The student evaluates resources in nutrition and food science.

- (7) **Food technology.** The student evaluates technologies used in food processing and product development.

- (C) compare the effects of various cooking utensils and equipment on food products;
- (D) evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products; and
- (E) apply the principles of food preparation to preserve quality and nutritive value of foods.

The student is expected to:

- (A) describe the processes of digestion and metabolism;
- (B) explain basal and activity metabolisms and factors that affect each; and
- (C) apply knowledge of digestion and metabolism when making decisions related to food intake and physical fitness.

The student is expected to:

- (A) plan diets appropriate to life cycle, activity level, culture, gender, and food budget;
- (B) develop examples of therapeutic diets;
- (C) explain consequences of eating disorders on long-term health;
- (D) devise strategies to deal with special dietary considerations including needs of women during pregnancy and lactation; and
- (E) utilize various guidelines and technology in evaluating diets.

The student is expected to:

- (A) evaluate resources that provide reliable nutrition information; and
- (B) propose ways to disseminate reliable nutrition information.

The student is expected to:

- (A) summarize new research and trends;
- (B) assess methods of food processing and their impact on product quality and nutrition;

- (8) **Food technology.** The student evaluates safety and sanitation standards.

- (9) **Food technology.** The student differentiates the effects of technology on nutrition, the food supply, marketing, and distribution.

- (10) **Food technology.** The student utilizes research skills in conducting and evaluating scientific research in food science.

- (C) explain the roles of additives in food processing; and
(D) contrast the effects of packaging on the properties and quality of the food and on the environment.

The student is expected to:

- (A) describe properties of microorganisms that cause food spoilage and food-borne illness;
(B) outline sanitation and food-handling practices that can help prevent food contamination and food-borne illness;
(C) describe functions of government agencies that regulate food quality, wholesomeness, and safety; and
(D) analyze industry quality control standards and skills related to safety and safe working conditions.

The student is expected to:

- (A) determine the effects of technological advances on food availability;
(B) interpret how consumer choice is influenced by market research and marketing in the field of food science and nutrition;
(C) summarize the relationship of entrepreneurial opportunities, technological advances, and marketing research; and
(D) determine the effects of advancements in food science and technology on family strengths and the welfare of family members.

The student is expected to:

- (A) analyze various research methods used in food science, technology, and nutrition;
(B) describe ways to choose topics for research in food science, technology, and nutrition;
(C) evaluate research projects related to a current issue in food science, technology, and nutrition; and

- (11) **World food supply.** The student contrasts basic physical survival with quality of life.
- (12) **World food supply.** The student analyzes food supply, distribution, and nutrition from a global perspective.
- (13) **Career preparation.** The student determines opportunities and preparation requirements for careers in nutrition, food science, and food technology.
- (D) utilize research methods to create projects related to a current issue in food science, technology, and nutrition.
- The student is expected to:
- (A) describe the relationship of good health and nutrition to job performance and relationships;
- (B) explain the relationship of the food supply to quality of life;
- (C) explain how the long-term effects of hunger affect a society and world progress; and
- (D) contrast the nutrition in developed and developing countries.
- The student is expected to:
- (A) analyze factors that influence the food chain, pricing, and choices;
- (B) determine the demands placed on food science and technology by American societal patterns;
- (C) describe technological, ecological, and sociological factors affecting world food supply;
- (D) explain the roles that world food trade policies and governments play in world progress related to nutrition;
- (E) describe international organizations dealing with world food supply and contributing to improved nutrition;
- (F) analyze the problems of world hunger; and
- (G) predict possible solutions to the problems of world hunger.
- The student is expected to:
- (A) determine employment and entrepreneurial opportunities and preparation requirements for careers in nutrition, food science, and technology;
- (B) compare personal characteristics to those needed for careers in nutrition, food science, and technology; and

- (14) **Career preparation.** The student exhibits employability skills.

- (C) propose short-term and long-term career goals.

The student is expected to:

- (A) describe management practices facilitating individuals assuming multiple family, community, and wage-earner roles;
- (B) practice positive human-relations skills;
- (C) demonstrate effective verbal, nonverbal, written, and electronic communication skills;
- (D) demonstrate effective methods to secure, maintain, and terminate employment;
- (E) identify ethical practices in the workplace; and
- (F) practice problem solving, using leadership and teamwork skills.

- (15) **Career preparation.** The student completes a supervised career-connections experience applying knowledge and skills developed in the study of food science and technology.

The student is expected to:

- (A) determine home and business applications of knowledge and skills developed in the study of food science and technology; and
- (B) utilize a career-connections experience to demonstrate occupational applications of competencies developed in the study of food science and technology.

Explanation of Block Plans

NOTE TO THE TEACHER

The block plans are included strictly as one example of how each course might be carried out in the available instructional time. It is intended that the block plans will serve only as an aid to teachers in planning instruction for the Texas Essential Knowledge and Skills for the course.

There will be many instances where time allotments as shown on the block plans will vary from time allotments as planned in your classroom. Factors impacting actual allotment include class size, length of class period, the school calendar, and local district policies. Also, time allotment will vary according to selected instructional strategies and the degree of emphasis placed on specific strategies and TEKS.

Local districts are encouraged to use the blank block forms found in this section to customize plans to accommodate other scheduling arrangements or to otherwise meet individual needs.

BEST COPY AVAILABLE

Food Science and Technology

Sample Six Weeks Plan

55 minute periods

1st Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Course Introduction 15A and 15B Introduction to Career-connections experiences	EKS #1 Relation of Nutritional Adequacy to Personal Health 1A Functions of nutrients in the body 1B Relationship of nutrients and other factors to diet-related diseases and disorders			
Week 2	EKS #4 Knowledge of Digestion and Metabolism to Establish Lifelong Habits of Good Nutrition and Physical Fitness 4A Processes of digestion and metabolism 4B Basal and activity metabolisms and factors affecting each 4C Knowledge when making decisions related to food intake and physical fitness				
Week 3	EKS #5 Available Technology to Plan Diets Appropriate for Long-term Health and Wellness 5C Consequences of eating disorders on long-term health	5D Strategies to deal with special dietary considerations	5B Examples of therapeutic diets 5E Various guidelines and technology in evaluating diets	5A Diets appropriate to life cycle, activity level, culture, gender, and food budget	
Week 4	1C Cultural food patterns 1D Culturally diverse food choices	EKS #6 Resources in Nutrition and Food Science 6A Reliable resources	6B Ways to disseminate reliable nutrition information	EKS #3 Variety of Changes That Affect Food Quality 3A Science process skills in conducting laboratory activities	
Week 5	3B Chemical reactions that occur during food processing		3C Effects of various cooking utensils and equipment on food products		3D Effect of various temperatures, manipulative procedures, and leavening agents on food products
Week 6	3D →			Review	Test

Food Science and Technology

Sample Six Weeks Plan 55 minute periods

2nd Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	EKS #2 Ways to Maximize Quality Nutrition				
	2A Various methods for retaining nutrients and improving nutritive content in foods		3E Principles of food preparation to preserve quality and nutritive value of foods		2B Impact of new technology on food science
Week 2	EKS #10 Research Skills in Conducting and Evaluating Scientific Research in Food Science				
	10A Various research methods used in food science, technology, and nutrition	7A New research and trends 10B Ways to choose topics for research in food science, technology, and nutrition	10C Research projects related to a current issue in food science, technology, and nutrition	10D Research methods to create projects related to a current issue in food science, technology, and nutrition Introduce Research Project	
Week 3	EKS #7 Technologies Used in Food Processing and Product Development			EKS #8 Safety and Sanitation Standards	
	7B Methods of food processing and impact on product quality and nutrition	7C Roles of additives in food processing	7D Effects of packaging on the properties and quality of the food and on the environment	8A Properties of microorganisms that cause food spoilage and food-borne illness	
Week 4	8A Continued	8B Sanitation and food-handling practices that can help prevent food contamination and food-borne illness		8D Industry quality control standards and skills related to safety and safe working conditions	
Week 5	8C Functions of government agencies that regulate food quality, wholesomeness, and safety	EKS #9 Effects of Technology on Nutrition, Food Supply, Marketing, and Distribution			
		9A Effects of technological advances on food availability	9B How consumer choice is influenced by market research and marketing in the field of food science and nutrition	9C Relationship of entrepreneurial opportunities, technology, and marketing	9D Effects of advancements on the family
Week 6	Research Project in Food Science and Technology			Review	Test

Food Science and Technology

Sample Six Weeks Plan 55 minute periods

3rd Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	EKS #11 Basic Physical Survival With Quality of Life 11A Relationship of good health and nutrition to job performance and relationships 11B Food supply and quality of life			11C Long-term effects of hunger affect a society and world progress	
Week 2	EKS #12 Food Supply, Distribution, and Nutrition from a Global Perspective 12A Factors that influence the food chain, pricing, and choices			12B Demands placed on food science and technology by American societal patterns	12C Technological, ecological, and societal factors affecting world food supply
Week 3	12D Roles that world food trade policies and governments play in world progress related to nutrition 12E International organizations dealing with world food supply and contributing to improved nutrition		12F Problems of world hunger 12G Possible solutions to the problems of world hunger	→	
Week 4	EKS #14 Employability Skills 14C Effective verbal, nonverbal, written, and electronic communication skills		14B Positive human-relations skills	14F Problem solving, leadership, and teamwork skills	EKS #13 Career Opportunities 13C Short-term and long-term career goals
Week 5	13B Personal characteristics	13A Employment and entrepreneurial opportunities and preparation requirements	14D Effective methods to secure, maintain, and terminate employment		14A Management practices facilitating multiple roles
Week 6	14E Ethical practices in the workplace	EKS #15 Career-Connections Experience 15A and 15B Culmination of career-connections experiences		Review	Exam

Food Science and Technology

Sample Six Weeks Plan 90 minute periods

1st Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Course Introduction 13A and 13B Introduction to career-connections experiences		EKS #1 Relation of Nutritional Adequacy to Personal Health 1A Functions of nutrients in the body 1B Relationship of nutrients and other factors to diet-related diseases and disorders		1A and 1B Continued
Week 2		EKS #4 Knowledge of Digestion and Metabolism to Establish Lifelong Habits of Good Nutrition and Physical Fitness 4A Processes of digestion and metabolism 4B Basal and activity metabolisms and factors affecting each 4C Knowledge when making decisions related to food intake and physical fitness			
Week 3	EKS #5 Available Technology to Plan Diets 5C Consequences of eating disorders on long-term health		5D Strategies for special dietary considerations 5B Therapeutic diets 5E Guidelines and technology in evaluating diets		1C Cultural food patterns 1D Culturally diverse food choices 5A Diets appropriate to life cycle, activity level, culture, gender, and food budget
Week 4		EKS #6 Resources in Nutrition and Food Science 6A Reliable resources 6B Ways to disseminate reliable nutrition information		EKS #3 Variety of Changes That Affect Food Quality 3A Science process skills in conducting laboratory activities	
Week 5	3B Chemical reactions that occur during food processing		3C Effects of various cooking utensils and equipment on food products		3D Effect of various temperatures, manipulative procedures, and leavening agents on food products
Week 6		3D Continued		Review Test	

Food Science and Technology

Sample Six Weeks Plan 90 minute periods

2nd Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	EKS #2 Ways to Maximize Quality Nutrition 2A Various methods for retaining nutrients and improving nutritional content in foods		3E Principles of food preparation to preserve quality and nutritive value of foods		2B Impact of new technology on food science 7A New research and trends
Week 2		EKS #10 Research Skills in Conducting and Evaluating Scientific Research in Food Science 10B Ways to choose research topics 10C Research projects related to a current issue		10A Various research methods 10D Research methods to create projects related to a current issue Introduce Research Project	
Week 3	EKS #7 Technologies Used in Food Processing and Product Development 7B Methods of food processing and impact on product quality and nutrition		7C Roles of additives in food processing		7D Effects of packaging on the properties and quality of the food and on the environment
Week 4		EKS #8 Safety and Sanitation Standards 8A Properties of microorganisms 8B Sanitation and food-handling practices		8C Functions of government agencies 8D Industry quality control standards and skills	
Week 5	EKS #9 Effects of Technology 9A Effects of technological advances on food availability 9B How consumer choice is influenced		9C Relationship of entrepreneurial opportunities, technology, and marketing 9D Effects of advancements on the family		Research Project in Food Science and Technology
Week 6		Research Project		Review Test	

Food Science and Technology

Sample Six Weeks Plan 90 minute periods

3rd Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	EKS #11 Basic Physical Survival With Quality of Life 11A Relationship of good health and nutrition to job performance and relationships 11B Food supply and quality of life				
			11C Long-term effects of hunger affect a society and world progress 11D Nutrition in developed and developing countries		
Week 2		EKS #12 Food Supply, Distribution, and Nutrition from a Global Perspective 12A Factors that influence the food chain, pricing, and choices 12B Demands placed on food science and technology by American societal patterns 12C Technological, ecological, and societal factors affecting food supply			
Week 3	12D Roles of world food trade policies and governments 12E International organizations dealing with world food supply		12F Problems of world hunger 12G Possible solutions to the problems of world hunger		12F ☐ Continued 12G ☐
Week 4		EKS #14 Employability Skills 14B Positive human relations skills 14C Effective verbal, nonverbal, written, and electronic communication skills		14E Ethical practices in the workplace 14F Problem solving, leadership, and teamwork skills	
Week 5	EKS #13 Career Opportunities 13A Employment and entrepreneurial opportunities and preparation requirements 13B Personal characteristics 13C Short-term and long-term goals		14D Effective methods to secure, maintain, and terminate employment		14A Management practices facilitating multiple roles
Week 6		EKS #15 Career-Connections Experience 15A and 15B Culmination of career-connections experiences		Review Exam	

Sample Six Weeks Plan
55 minute periods

Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1					
Week 2					
Week 3					
Week 4					
Week 5					
Week 6					

Sample Six Weeks Plan
90 minute periods

Six Weeks

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1					
Week 2					
Week 3					
Week 4					
Week 5					
Week 6					

Food Science and Technology Laboratory Experiences

NOTE TO THE TEACHER

Strategies for integrating laboratory experiences in the Food Science and Technology course are presented throughout this instructional guide. Students need to learn concepts related to laboratory planning, safety, sanitation, management, and assessment prior to their first laboratory experience. TEKS 1, 2, and 3 focus on food science principles; therefore, many of the student expectations for these TEKS may need to be covered at the beginning of the semester as you introduce knowledge and skills needed for successful laboratory experiences. Some laboratory experiences in the Food Science and Technology course include the use of science laboratory equipment; students will need instruction or review on the safe use of these laboratory tools.

The Texas Education Agency maintains a Web site on Texas Safety Standards for public schools that provides detailed information on laws and regulations, safety concerns, and equipment for classroom laboratories. Included in the Appendices of this Web site are safety forms, laboratory checklists, hazardous chemical lists, safety symbols, and other valuable teacher and student information. You are encouraged to visit this Web site to acquire these valuable tools and information at the following address:

www.tenet.edu/teks/science/stacks/safety/safetymain.html

Information on planning and conducting laboratory experiences is found on Teaching Aids 1 through 10. Teaching Aids 1 through 10 are designed to assist teachers and students with preparation and use of laboratory experiences as instructional tools for the Food Science and Technology course. Because these Teaching Aids have multiple applications throughout the course, they are labeled "Lab" rather than with a specific TEKS number. These Teaching Aids include:

- **TA 1** *Tips for Teachers: Laboratory Experiences in Food Science and Technology*
- **TA 2** *Rules for Personal Hygiene and Sanitation in the Food Science Laboratory*
- **TA 3** *Rules for Cleanliness in Food Preparation Areas*
- **TA 4** *Safety in the Food Science Laboratory*
- * • **TA 5** *A Laboratory Microscope*
- * • **TA 6** *Basic Food Science Laboratory Equipment and Supplies*
- **TA 7** *The Scientific Method for Food Science Experiments*
- **TA 8** *Laboratory Plan of Work*
- **TA 9** *Laboratory Assessment: Food Products*
- **TA 10** *Laboratory Report: Food Science Experiments*

- * Invite the science teacher to speak to the class on the safe use and care of science laboratory equipment such as the microscope, balance, glass equipment, etc.

Food Science and Technology

Knowledge and Skills.

(1) Food science principles.

The student relates nutritional adequacy to personal health.

The student is expected to:

- (A) describe the functions of nutrients in the body;
- (B) analyze the relationship of nutrients and other factors to diet-related diseases and disorders;
- (C) relate cultural food patterns to personal health; and
- (D) analyze culturally diverse food choices that are nutritionally adequate.

1A- The student is expected to describe the functions of nutrients in the body.

1) CLASS DISCUSSION/GROUP ACTIVITY



Write the phrase, "the study of nutrition," on the board or a transparency. Ask students to define the term *nutrition*. Emphasize that the study of nutrition involves a study of the nutrients and how the body uses them. Display Teaching Aid 11, **Nutrient Groups**, on the overhead projector. Discuss with students how all the nutrients are classified into one of these six groups. Instruct students that they are going to "teach" each other about the key nutrients and their functions in the body.

Divide the students into nine groups assigning each group one of the following topics:

- protein
- carbohydrates
- fat-soluble vitamins (vitamins A, D, E, K, and provitamin beta carotene)
- B-vitamins (riboflavin, thiamin, niacin, B₆, B₁₂)
- Vitamin C, folate, biotin, pantothenic acid
- macrominerals (calcium, phosphorus, magnesium and electrolytes sodium, chloride, and potassium)
- microminerals (iron, zinc, copper, selenium, iodine, fluoride)
- fats
- water

Using Chapter 3 in the *Food Science and Technology Reference Book* and other resources, have each group research information on their nutrient topic and prepare a mini-lesson to teach the rest of the class about their nutrient(s). Information presented should include functions in the body, food sources, results of deficiencies, and implications for good health. Students should use software and other visual aids, such as Power Point, posters, transparencies, videos, food models, etc., to assist with their presentation.

Distribute copies of Teaching Aids 12a and 12b, **The Nutrients**, to students. Have students use this tool to record information on the nutrients presented by the student groups.

KEY QUESTIONS

- What is nutrient teamwork?
- What are some examples of nutrient teamwork?
- What is the difference between fat-soluble and water-soluble vitamins?
- What is cholesterol?
- Why is an understanding of the nutrients and their functions important to maintaining good health?

NOTES

TA 11 Nutrient Groups

**TA 12a-b
The Nutrients**

**TAAS
READING**

SCIENCE



NOTES

TA 13 *Nutrient Terms*

TA 14 *"Jeopardy"
Game
Instructions*

SCIENCE

SCIENCE



2) GAME

Write the terms found on Teaching Aid 13, *Nutrient Terms*, on index cards creating as many cards as there are students in the class. Additional nutrient terms may be used if needed so as to have a different card for each student in the class. Have each student draw one card and use resources and information presented in Strategy 1 to find a definition of the term and write it on the back of the card.

Use these cards as the subject matter for a game of "Jeopardy" to help students learn the nutrients and their functions. See Teaching Aid 14, *"Jeopardy" Game Instructions*, for detailed instructions for the "Jeopardy" game.



3) GUEST SPEAKER

Invite a registered dietitian to speak to the class on the importance of the nutrients to overall health and wellness throughout the life span. Suggested speakers include the school district dietitian, hospital dietitian, public health dietitian, Education Service Center nutrition specialist, etc. Ask the speaker to emphasize to students the importance of lifelong healthy eating habits and the reasons for developing those habits now. The speaker might also include information on careers in nutrition and dietetics.

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Fundamental Human Nutrition*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape on the nutrients. Lead a class discussion on the functions of the nutrients in the body and their role in optimal health.

FCCLA ACTIVITIES

- Power of One: A Better You; Working on Working
- Student Body

RESOURCES

BOOKS

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 3.

Home Economics Curriculum Center, 1997. *Skills for Life*, Module 2D, "Human Nutrition."

VIDEOTAPE

Fundamental Human Nutrition, available from The Curriculum Center for Family and Consumer Sciences.

1B- The student is expected to analyze the relationship of nutrients and other factors to diet-related diseases and disorders.

1) BRAINSTORMING/CLASS DISCUSSION



Have students read Chapters 2 and 6 in the *Food Science and Technology Reference Book* or read other resources on the topic of diet-related diseases and disorders. Have students brainstorm and identify examples of diet-related diseases and disorders. Examples include:

- anorexia nervosa
- bulimia nervosa
- cancer
- cardiovascular disease
- diabetes
- food allergies
- food intolerances
- hypertension
- obesity
- osteoporosis

Using Teaching Aids 15a-b, *Diet-related Diseases and Disorders*, displayed on the overhead projector or distributed as a student information sheet, lead a class discussion on the factors involved in each of these examples and how they are related to nutrition. Teaching Aid 16, *Dietary Guidelines for Americans*, and Teaching Aid 17, *Food Guide Pyramid*, can be used as transparency masters to assist you in leading the class discussion.

KEY QUESTIONS

- What is the relationship between sodium and hypertension?
- What is cardiovascular disease?
- What is the relationship between fat intake and cardiovascular disease?
- According to recent scientific research, how are diet, nutrition, and cancer related?
- What is the purpose of insulin?
- What is the difference between Type 1 and Type 2 diabetes?
- What can be done to prevent osteoporosis?
- How are additional health problems associated with obesity?

2) INTERNET SEARCH/RESEARCH/ORAL PRESENTATION



Have students use the Internet to research information on one of the diet-related diseases or disorders identified in Strategy 1 above. Students may choose to work in pairs or individually. Instruct students to prepare an Illustrated Talk on their chosen topic being certain to include a discussion of the relationship of nutrients and other factors to the diet-related disease or disorder they are investigating. Have

NOTES

TA 15a-b

*Diet-related
Diseases and
Disorders*

TA 16

*Dietary
Guidelines for
Americans*

TA 17

*Food Guide
Pyramid*

TAAS
READING

SCIENCE

TAAS
READING

SCIENCE



NOTES



SCIENCE



students use posters, transparencies, videotapes, Power Point presentations, or other media to assist them with an oral presentation to the class.

As a FCCLA project, chapter members could give their presentations to older elementary students emphasizing the importance of good eating habits for a lifetime.



3) VIDEOTAPE/TEAMWORK

Divide students into groups of four. Randomly assign each group one of the diet-related diseases or disorders previously discussed in class. Instruct teams to design a 2-3 minute public service announcement (PSA), videotape it, and then present it to the class. For examples of public service announcements, record several that are shown on commercial and public broadcasting channels. Examples could include PSAs related to illegal drug use, staying in school, and the dangers of drunk driving. These videotapes could also be used in the community as a public service of the FCCLA chapter.

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Eating for Life*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape on the relationship of nutrients to good health. Lead a class discussion on information presented in the video.

FCCLA ACTIVITIES

- Power of One: A Better You; Take the Lead
- STAR Events: Applied Technology; Chapter Service Project; Illustrated Talk; Skills for Life

RESOURCES

BOOKS

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 2 and 6.

Home Economics Curriculum Center, 1997. *Skills for Life*, Module 2C, "Weight Control," Module 2D, "Human Nutrition," and Module 2G, "Cancer and Heart Disease."

VIDEOTAPE

Eating for Life, available from The Curriculum Center for Family and Consumer Sciences.

1C- The student is expected to relate cultural food patterns to personal health.

1) WEB DIAGRAM/GROUP ACTIVITY



Cultural food patterns are the "what, when, and with whom" of eating influenced by one's culture. Discuss with students how one's food choices and eating patterns are affected by culture. It is important to look first at what influences cultural food patterns.

Have students read Chapter 14 in the *Food Science and Technology Reference Book* for background information related to this topic. Divide students into small groups. Instruct students to create a web diagram with the center circle titled, "Factors that influence cultural food patterns." Tape a large sheet of butcher paper to the wall, and draw the center circle with the title. Have one person from each group continue to add circles (one at a time) to the class web diagram until all of the students' ideas have been written. Next, instruct the students to go back to their groups and discuss "how" these factors influence cultural food patterns. Have the students expand the class web diagram with their "how" responses. Teaching Aid 18, **Factors That Influence Cultural Food Patterns**, is provided as a teacher resource for this activity.

KEY QUESTIONS

- How does cultural background influence food choices?
- What cultural food patterns are common in this community?
- What cultural food patterns are common in Texas?
- How are cultural food patterns related to personal health?
- How are tools, such as the Food Guide Pyramid, Dietary Guidelines, and Recommended Dietary Allowances, helpful in analyzing the nutritional contributions of cultural foods?

2) PROJECT/TEAMWORK/VISUAL DISPLAY



Divide students into teams. Assign each team a cultural group, and instruct each team to research cultural food patterns of their cultural group. Examples of cultural groups students may choose to research include:

- | | |
|-------------------|--------------------|
| • African | • Japanese |
| • Arab | • Korean |
| • Asian Indian | • Mexican |
| • Brazilian | • Native-American |
| • British | • Nigerian |
| • Chinese | • Pacific Islander |
| • Dutch | • Pakistani |
| • French-Canadian | • Russian |
| • German | • Vietnamese |
| • Italian | • Welsh |

NOTES

TA 18 **Factors That Influence Cultural Food Patterns**

SOCIAL
STUDIES

TA 19a-b

Cultural Food Patterns

TAAS
READING

SOCIAL
STUDIES



NOTES



Tell students to avoid American cultural influences and instead to look at the culture's origin. Have students use Teaching Aids 19a-b, **Cultural Food Patterns**, to guide their information gathering. Using the information they gathered in their research, instruct students to design a Food Guide Pyramid for the cultural group they research. Provide butcher paper, poster board, or have students use computer software programs to design their pyramid. Have students indicate serving sizes if they have located that information. Instruct students to analyze the relationship of these food patterns to the personal health of individuals in that culture. Have each group present their pyramid to the class.

Note to the teacher: Cornell University has collaborated with other nutrition and medical experts in developing food guide pyramids for various cultural groups. This information can be found at their Web site.

FCCLA ACTIVITIES

- Families First: Families Today
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 14.

WEB SITE

Cornell University

www.news.cornell.edu/eg.acgi

[Under "query," type in "Food Guide Pyramid" and it will show a table of contents listing the various pyramids they have developed.]

1D- The student is expected to analyze culturally diverse food choices that are nutritionally adequate.

1) CLASS DISCUSSION/GROUP ACTIVITY



Lead a class discussion about the relationship of culture to dietary practices emphasizing the following:

- *Culture* is the beliefs, ideas, customs, and habits accepted by a group of individuals.
- The population of the United States is made up of many ethnic and cultural groups. The food habits of Americans are as diverse as the population.
- Each ethnic and cultural group has its own food habits and cultural food items.
- Food habits are influenced by every individual's cultural background.
- The influence of cultural food habits on an individual's daily food practices varies from person to person.

Display 5-7 food items from the list on Teaching Aid 20, **Cultural Foods**, or others you choose. Number each food item on a 3x5 index card placed in front of the foods on display. Instruct students to try and identify each food and name the country of origin. Write the name of the food and the country on the back of each index card, and turn the cards over to reveal the names as you lead a discussion about the various foods and how they are common food choices for some cultural groups.

Divide students into small groups, and divide the food items on the list (see Teaching Aid 20) among the groups. Instruct students to use dietary analysis computer programs to analyze the nutritional value of the various foods. Note that some dietary analysis programs are limited in the number of cultural foods that they include. Students also may need to use additional print resources.

KEY QUESTIONS

- How are food choices affected by cultural background?
- How are food choices affected by geography?
- What is the relationship of food choices to economics?
- How do cultural food habits, family traditions, and family food patterns affect individual food choices?

2) GROUP ACTIVITY/COMPUTER EXERCISE



Divide students into small groups or teams for the computer exercise. Using Teaching Aid 21, **Cultural Food Choices: What Is the Nutritional Value?**, assign the student groups the various cultural food selections. Note that some of the foods just list fruits or vegetables. Tell the students to list the nutrients most commonly found in fruits and veg-

NOTES

TA 20 **Cultural Foods**

SOCIAL
STUDIES



TA 21 **Cultural Food Choices: What Is the Nutritional Value?**

NOTES

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STUDIES

etables. Have students use dietary analysis computer software to determine the nutrient composition of the foods in their assigned food selections. Instruct students to print out the nutritional information and prepare a transparency to share with the class that reflects the nutritional value for each of the foods.

KEY QUESTIONS

- What nutrients are prominent in the various cultural food selections?
- How have Americans adapted some of these cultural foods to fit into their diets?
- How has the influence of cultural foods in the United States affected the popularity of restaurants serving international cuisine?

3) PROJECT/FCCLA

Have a Multicultural Food Fest in association with a PTA meeting or other school function. Chapter members can research and prepare cultural foods from different regions of the world and have a "tasting fest" where parents and students taste the various foods. Chapter members could solicit assistance from parents in the school with background or experience in preparing certain cultural food items. Stress to students the importance of sharing the nutritional value of each of the food items with the participants in the food fest.

This also could be done as a team teaching project with history, geography, or foreign language teachers. In lieu of taste testing, chapter members could set this up just as an educational exhibit.



SOCIAL
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FCCLA ACTIVITIES

- Power of One: A Better You; Family Ties
- Student Body: Students broaden their food choices by incorporating different food items in their meals, such as substituting tofu for the beef or sausage in lasagne, stroganoff, spaghetti, tacos, etc.

RESOURCES

BOOKS

Fortin, F., 1996. *The Visual Food Encyclopedia*. Canada: Macmillan, Inc.

Home Economics Curriculum Center, 1997. *Skills for Life*, Module 1C, "Understanding Cultural Differences."

Kittler, P.G. and Sucher, K. P. 1998. *Food and Culture in America*. Belmont, CA: Wadsworth Publishing.

Food Science and Technology

Knowledge and Skills.

(2) Food science principles.

The student analyzes ways to maximize quality nutrition.

The student is expected to:

(A) determine various methods for retaining nutrients and improving nutrient content in foods; and

(B) describe the impact of new technology on food science.

2A- The student is expected to determine various methods for retaining nutrients and improving nutrient content in foods.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 7 in the *Food Science and Technology Reference Book* on methods for retaining nutrients in food. Display Teaching Aid 22, **Preserving Nutrients**, on the overhead projector. Lead a class discussion emphasizing each of the points for preserving nutrients listed.

KEY QUESTIONS

- What is the purpose of chilling some fruits and vegetables soon after harvest?
- How is leaching of vitamins and minerals into the cooking water prevented?
- Why is heat important in food preparation?
- How is heat a factor in nutrient retention?

Display Teaching Aid 23, **Technology and Trends in Nutrient Retention**, on the overhead projector. Assign groups of students different methods to report on to the class using information from Chapter 4 and/or other resources. Have students use Teaching Aid 24, **Technology and Trends in Nutrient Retention Worksheet**, to record information presented by class members.



2) GUEST SPEAKER

Invite a grocer, retail food distributor, or other resource person to speak to the class about methods used by grocers and manufacturers to retain nutrients in foods.

KEY QUESTIONS

- What are effective ways being used to retain nutrients in foods?
- Are all processing methods equally effective for nutrient retention? Why?
- What new trends in handling and storage of fresh produce are helping to retain nutrients in these foods?

3) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 3 in the *Food Science and Technology Reference Book* on ways for improving the nutrient content of foods. Display Teaching Aid 25, **Terms to Know**, on the overhead projector and discuss each of the terms with the students.

NOTES

TA 22 **Preserving Nutrients**

TA 23 **Technology and Trends in Nutrient Retention**

TA 24 **Technology and Trends in Nutrient Retention Worksheet**

TAAS
READING

SCIENCE

SCIENCE

TA 25 **Terms to Know**

TA 26 **Improving the Nutrient Content of Foods**

NOTES

TAAS
READING

SCIENCE

SCIENCE

KEY QUESTIONS

- What is the difference between fortification, enrichment, and restoration?
- What are examples of incomplete proteins combined to form complete proteins?
- How can the protein content of a food be increased?
- What are analogues?
- What is meant by enrichment? Which nutrients must be present for a food to carry the label, "Enriched"?
- What nutrients are most often added to breakfast cereals?

Distribute copies of Teaching Aid 26, *Improving the Nutrient Content of Foods*, to students and discuss the suggestions listed.

4) LABORATORY EXPERIENCE

Have students conduct the following recipe development experiments:

- Determine how much sugar, salt, or fat can be removed from recipes before the palatability and texture is affected significantly.
- Increase the fiber content in recipes.
- Determine ways to alter or supplement selected recipes to make them more nutritious.

Examples include:

- Substituting milk for water
- Adding meat, tofu, or nuts to vegetable dishes
- Adding textured vegetable protein to recipes
- Adding fruit juice to vegetable dishes
- Adding grated carrots or other vegetables to casseroles, cakes, cookies, breads, etc.
- Using herbs and spices to flavor foods in place of added fat or salt

Following this activity, have students evaluate their use of appropriate laboratory knowledge and skills in conducting this experiment.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 3 and 7.

2B- The student is expected to describe the impact of new technology on food science.

1) RESEARCH/WRITTEN EXERCISE/SYMPOSIUM

Define *technology* for students. *Technology* is the combination of knowledge, tools, and techniques that enable the accomplishment of a task. Instruct students to read Chapter 16 in the *Food Science and Technology Reference Book* for information on the impact of new technology on food science. Using Teaching Aid 27, **Symposium: The Impact of Technology on Food Science**, have students select a research topic from the list or select other topics related to the impact of technology on food science. Group students according to their research topics, and have them participate in a class symposium.

Encourage students to use library resources and the Internet, especially Web sites from land grant universities, Texas A&M Agricultural Extension Service, and food technology sites. Following the symposium, have students turn in a written summary of the information they gathered on their topic.

2) EDUCATIONAL TOUR

Arrange for students to visit a local supermarket to find examples of the following:

- dehydrated foods
- freeze-dried foods
- IQF (individually quick frozen)
- hydroponically-grown foods
- genetically-engineered foods
- retort pouches

Have students use Teaching Aid 28, **Supermarket Scavenger Hunt**, to record their findings at the store. Instruct students to complete Part II of the worksheet by listing any food products that reflect new technologies in the food industry. If possible, purchase some of the foods the students found on the scavenger hunt for taste testing during another class period.

KEY QUESTIONS

- How have the foods on the supermarket shelf changed in the last ten years?
- How have these technological advances in the food industry been advantageous for the consumer?
- How have these technological advances in the food industry been advantageous to food production industries?

3) WRITTEN EXERCISE

Have students write a creative paper describing foods which may be a

NOTES

TA 27 Symposium: The Impact of Technology on Food Science

TAAS
READING

TAAS
WRITING

SCIENCE



TA 28 Supermarket Scavenger Hunt

SCIENCE

NOTES

TAAS
WRITING

SCIENCE



TA 29 *Sensory
Evaluation of
Food Products*

TA 30a-b
*Terms Used in
Evaluating Food
Products*

SCIENCE

RESOURCES, cont'd

WEB SITES

Food and Drug
Administration
www.fda.gov
Food and Nutrition
Information Center/USDA
www.usda.gov/fnic
Institute of Food
Technologists
www.ift.org/
Internet Public Library
www.ipl.org
Virtual Reference Desk
www.refdesk.com

part of the American diet in the year 2030. Tell students to consider advancements in food science and nutrition as they think critically and predict foods for the future.

KEY QUESTIONS

- What knowledge and skills do scientists and food technologists have now that lead to new developments in food science and food technology?
- What do futurists predict for "foods of the future"?
- What diet-related health problems are present today that developments in food science and nutrition could lead to solutions? How?
- What advancements in food science and food technology will benefit families in the future?

4) LABORATORY EXPERIMENT

As an enrichment experience, have students investigate the history of breadmaking or view a video on current technology used in breadmaking in the food industry. Have students participate in a laboratory experience making a variety of bread products using different flours and ingredients. Examples include whole wheat, rye, pumpernickel, potato, sourdough, unleavened, etc. Have students prepare a chart of the ingredients and procedures used and then compare and contrast with the other lab groups. Use Teaching Aid 29, *Sensory Evaluation of Food Products*, as a tool for students to evaluate the bread products.

Teaching Aids 30a-b, *Terms Used in Evaluating Food Products*, is provided as a reference for teachers and students.

KEY QUESTIONS

- How has technology affected the commercial production of bread and other baked products?
- What do you consider the most valuable technological advancement in the production of commercial baked products? Why?
- What were the results of the sensory evaluation of the products prepared in class?

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 16.

Food Science and Technology

Knowledge and Skills.

(3) Food science principles.

The student evaluates a variety of changes, including chemical and physical, that affect food product quality.

The student is expected to:

- (A) apply science process skills in conducting laboratory activities;
- (B) explain the chemical reactions that occur during food processing;
- (C) compare the effects of various cooking utensils and equipment on food products;
- (D) evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products; and
- (E) apply the principles of food preparation to preserve quality and nutritive value of foods.

3A- The student is expected to apply science process skills in conducting laboratory activities.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION/WRITTEN EXERCISE

Have students read Chapter 8 in the *Food Science and Technology Reference Book* regarding the scientific method of investigation. Display Teaching Aid 31, *The Scientific Method of Investigation*, on the overhead projector, and lead a class discussion on the scientific process and the skills needed for conducting scientific investigation. Discuss with students that food science is a field of study that involves scientific problem solving using a variety of science process skills.

Distribute copies of Teaching Aids 32a-b, *Scientific Problem Solving*, to students. Instruct students to read and review the top portion of the worksheet and then complete the written exercise at the bottom. When students have completed their work, lead a class discussion on the students' responses to the questions, reviewing the steps in the scientific method as needed.

2) CLASS DISCUSSION/INDIVIDUAL ACTIVITY/WRITTEN EXERCISE

Have students read Teaching Aid 33, *Methods for Recording and Organizing Information and Compiling Findings*, and keep for future reference. Display the following teaching aids on the overhead projector and discuss each example:

- Teaching Aid 34, *Data Table and Matrix Diagram*
- Teaching Aid 35, *Compare and Contrast Diagram*
- Teaching Aid 36, *Bar Graph*
- Teaching Aid 37, *Line Graph and Pie Graph*
- Teaching Aid 38, *Web Diagram*

Distribute copies of Teaching Aid 39, *Which Method to Use?*, to students, and have them complete the exercise by identifying the appropriate method and drawing an example of the table, graph, or diagram on the back of the worksheet. Have students share their responses with the class.

3) LABORATORY EXPERIENCE

Divide students into laboratory groups. Distribute copies of Teaching Aid 40, *Liquid Iron*, to students, and go over the details of the laboratory experiment with them. Instruct students to carefully read and follow the instructions for the experiment. Distribute copies of Teaching Aid 7, *The Scientific Method for Food Science Experiments*, to each student, and have them complete the worksheet for this assigned experiment. Tell students that they also are to select the methods for recording information and compiling findings which is best suited to this experiment. For this experiment, each student should turn in a completed copy of Teaching Aid 7 and copies of any charts, graphs, or diagrams they developed for use with this experiment.

NOTES

TA 31 *The Scientific Method of Investigation*

TA 32a-b
Scientific Problem Solving

TAAS
READING

SCIENCE

TA 33 *Methods for Recording and Organizing Information and Compiling Findings*

TAs 34-38 (listed at left)

TA 39 *Which Method to Use?*

TAAS
READING

SCIENCE

TA 40 *Liquid Iron*

TA 7 *The Scientific Method for Food Science Experiments*

SCIENCE

NOTES

Following the experiment, lead a class discussion over the procedures used and results of their experiments.

KEY QUESTIONS

- What was the problem to be identified?
- What was the hypothesis?
- What observations were made?
- What conclusions can be made as a result of this experiment?
- Which methods of recording information and compiling results were most appropriate for this experiment?

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Food Testing: Working with Yeast*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape that illustrates the step-by-step process of food science laboratory experiments. Lead a class discussion on information presented in the video.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 8.

VIDEOTAPE

Food Testing: Working with Yeast, available from The Curriculum Center for Family and Consumer Sciences.

3B- The student is expected to explain the chemical reactions that occur during food processing.

1) CLASS DISCUSSION/INDIVIDUAL ACTIVITY/WRITTEN EXERCISE

Have students read Chapter 8 in the *Food Science and Technology Reference Book* or other references that explain food processing. Use Teaching Aid 41, *What is Food Processing?*, Teaching Aid 42, *Preservation Methods Used in Food Processing*, and Teaching Aid 43, *Preparation Methods Used in Food Processing*, as the basis for a class discussion on food processing. Distribute copies of Teaching Aid 44a-b, *Food Processing Terms*, to students, and have them use the *Food Science and Technology Reference Book* or other references for information and explanation of the terms. Have the students share their explanations with the class.

KEY QUESTIONS

- What are the purposes of food processing?
- What is the purpose of chemical preservation of food?
- What home food preservation methods are most common?
- How has technology affected home food preservation methods?

2) VIDEOTAPE/CLASS DISCUSSION

Show a videotape on food processing, such as *The Dairy Plant* or *Blue Bell Ice Cream*, available from The Curriculum Center for Family and Consumer Sciences. Lead a class discussion on the commercial food processing methods students observed in the videos.

Distribute Teaching Aid 45, *Chemical Reactions That Occur During Food Processing*, to students to use as a student information sheet and discuss the information presented. Display Teaching Aid 46, *Basic Principles and Effects of Food Processing Methods*, on the overhead projector and/or distribute to students as a student information sheet. Discuss the chemical reactions that occur during food processing and the functions these chemical reactions perform.

KEY QUESTIONS

- What are examples of chemical reactions that occur during food processing?
- What factors influence the chemical reactions in food?
- Why are these chemical reactions important in food preservation?
- How are the science of chemistry and the science of microbiology related to the study of food science and nutrition?

NOTES

TA 41 *What is Food Processing?*

TA 42 *Preservation Methods Used in Food Processing*

TA 43 *Preparation Methods Used in Food Processing*

TA 44a-b
Food Processing Terms

TAAS
READING

SCIENCE

TA 45 *Chemical Reactions That Occur During Food Processing*

TA 46 *Basic Principles and Effects of Food Processing Methods*

TAAS
READING

SCIENCE

NOTES

SCIENCE

TA 47a-c

**Laboratory
Experiment:
Freezing
Vegetables**

TA 7 **The Scientific
Method for Food
Science
Experiments**

3) LABORATORY EXPERIENCE

Divide students into laboratory groups. In this experiment, students will observe the effect heat (through blanching or water bath canning) has on the retention of color, texture, and flavor in the preservation of vegetables. A test for the adequacy of the blanching process in inactivating the enzymes which destroy color, texture, and flavor should be done immediately after blanching and before freezing. However, an additional comparison of blanched and unblanched vegetables after freezing is also an effective tool in showing the effects of food preservation methods on the quality of the food product. A period of two to three months must pass before the vegetables will have been frozen long enough to show marked results. However, the catalase test should be done immediately after blanching and before freezing. The chemical reaction that occurs with this test allows students to observe whether or not the heat treatment (blanching) was sufficient to inactivate the enzymes that cause undesirable changes in frozen foods. Use Teaching Aids 47a-c, **Laboratory Experiment: Freezing Vegetables**, as a guide for the student laboratory experience. Teaching Aid 7, **The Scientific Method for Food Science Experiments**, will help students follow the scientific process and learn scientific process skills.

As an alternative and with direct teacher supervision or teacher demonstration, students could observe the effect of heat on the preservation of tomatoes using the water-bath canning method as compared to tomatoes just poured into jars and sealed without the water-bath process. (Tomatoes will mold.)

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 8.

VIDEOTAPES

Blue Bell Ice Cream, available from The Curriculum Center for Family and Consumer Sciences.

The Dairy Plant, available from The Curriculum Center for Family and Consumer Sciences.

WEB SITE

Ball Canning Company
www.homecanning.com

3C- The student is expected to compare the effects of various cooking utensils and equipment on food products.

1) **INDIVIDUAL ACTIVITY/LABORATORY EXPERIMENT**

Have students read Chapter 8 in the *Food Science and Technology Reference Book* or other references on the effects of cooking utensils and equipment on food products. Discuss with students some key points learned from their reading.

KEY QUESTIONS

- What are the advantages and disadvantages of cast iron cookware?
- Why is aluminum commonly used for cooking utensils and equipment?
- What are the advantages and disadvantages of glass cookware?
- What types of cookware and utensils are recommended for the microwave oven? What types are not recommended?
- What is the effect of the composition of the cookware on food products?
- What is the effect of the composition of the food product on various types of cookware?

Divide students into laboratory groups; it may be necessary for two or more groups to conduct the same experiments. The experiments are designed to test the following:

- Experiment #1: Test the effects of various cooking utensils on food product quality in microwave cookery.
- Experiment #2: Test the effects of various cooking utensils on food product quality in stovetop cookery.
- Experiment #3: Test the effects of various cooking utensils on food product quality in baking.

Use Teaching Aid 48, *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Microwave Cookery*, Teaching Aid 49, *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Stovetop Cookery*, and Teaching Aid 50, *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Baking*, to conduct the laboratory experiments. Teaching Aids 7-10 are effective tools to use in conjunction with this learning experience.

Have each lab group display the results of their experiment for the class to observe. Assign one student from each lab group to explain to the class their experimental procedures and results.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

NOTES

TAAS READING

TA 48 *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Microwave Cookery*

TA 49 *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Stovetop Cookery*

TA 50 *The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Baking*

TAs 7-10 Labs

SCIENCE

NOTES**SCIENCE****2) GROUP ACTIVITY/DEMONSTRATION**

Divide students into small groups. Have each group prepare a mock television demonstration on the selection and use of cooking utensils and equipment to ensure safety and resulting high quality food products. Students should use information gleaned from the reading in Strategy 1 and from other resources. Examples of topics for the mock television demonstrations include:

- Utensils and Equipment for Microwave Cooking
- Selecting Utensils and Equipment for Preparing Baked Products
- What Type of Pots and Pans Should I Buy?
- Glass Cookware in Today's Kitchens

If possible, videotape the student demonstrations for their review and evaluation at a later date.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 8.

3D- *The student is expected to evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products.*

1) INDIVIDUAL ACTIVITY/LABORATORY EXPERIENCE

Have students read the section in Chapter 10 of the *Food Science and Technology Reference Book* or other references on the effects of temperature on food products. Discuss information learned from the reading exercise.

KEY QUESTIONS

- What factors influence the type of cooking method selected?
- What factors influence the temperature selected for cooking various food products?
- What factors influence the length of the cooking time?
- What is the difference between dry-heat and moist-heat cooking methods?
- How does temperature affect the cooking of vegetables and fruits?

Divide students into laboratory groups. Teaching Aid 51a, *The Effects of Temperature on Food Products*, gives examples of laboratory experiences for students to experiment with the effects of hot and cold temperatures on different food products. Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

2) CRITICAL THINKING/LABORATORY EXPERIMENT

Have students complete the critical thinking activities described in Teaching Aid 51b, *The Effects of Temperature on Food Products: Critical Thinking*. These exercises provide students opportunities for reasoning and drawing conclusions based on information learned through the study of the effects of temperature on food products.

3) INDIVIDUAL ACTIVITY/LABORATORY EXPERIENCE

Have students read Chapter 10 in the *Food Science and Technology Reference Book* or other references on the effects of manipulative procedures on food products. Discuss information learned from the reading exercise.

KEY QUESTIONS

- What factors influence the type of mixing method selected?
- What is the difference between the muffin method and the biscuit method?
- What is the difference between the straight-dough method and the batter method for mixing yeast dough?
- What might be the difference in the texture of yeast breads kneaded mechanically with a dough hook on an electric mixer or bread machine versus kneading by hand?

NOTES

TA 51a *The Effects of Temperature on Food Products*

TAs 7-10 *Labs*

TA 57 *Biscuit and Muffin Scorecard*
(for product evaluation)

**TAAS
READING**

SCIENCE

TA 51b *The Effects of Temperature on Food Products: Critical Thinking*

SCIENCE

TA 52a-b
The Effects of Manipulative Procedures on Food Products

TAs 7-10 *Labs*

TA 58 *Yeast Bread and Pastry Scorecard*
(for product evaluation)

**TAAS
READING**

SCIENCE

NOTES

TA 53 *The Effects of Leavening Agents on Food*

Products: Air

TA 54 *The Effects of Leavening Agents on Food*

Products: Steam

TA 55 *The Effects of Leavening Agents on Food*

Products: Yeast

TA 56a-b *The Effects of Chemical Leavening Agents on Food Products*

TA 59 *Air, Steam, and Yeast as Leavening Agents Scorecard*

TA 60 *Chemical Leavening Agents Scorecard*

(TAs 59-60 for product evaluation)

TAAS
READING

SCIENCE

SCIENCE

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 10.

Divide students into laboratory groups. Teaching Aid 52a-b, *The Effects of Manipulative Procedures on Food Products*, gives examples of laboratory experiences for students to experiment with the effects of a variety of manipulative procedures on different food products. Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

4) INDIVIDUAL ACTIVITY/LABORATORY EXPERIENCE

Have students read Chapter 10 in the *Food Science and Technology Reference Book* or other references on the effects of leavening agents on food products. Discuss information learned from the reading exercise.

KEY QUESTIONS

- What is the purpose of leavening agents in baked products?
- How do air and steam cause a batter or dough to expand?
- What role does carbon dioxide play in preparing baked products?
- What are examples of chemical leavening agents?
- How are they similar? How are they different?

Divide students into laboratory groups. Teaching Aids 53-56a-b, *The Effects of Leavening Agents on Food Products*, give examples of laboratory experiences for students to experiment with the effects of different leavening agents on food products. Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

5) CRITICAL THINKING/GROUP ACTIVITY



Divide students into small groups. Have students locate various leavening agents (brands and types) at school, home, and at the grocery store. Have students also locate an assortment of boxed convenience products, such as cake and muffin mixes. Have them look at the ingredient list. Using all the collected items as a reference, have students respond to the following key questions.

KEY QUESTIONS

- Which chemical leavening agents are used most often (phosphate, sulfate, tartrate)?
- What is the leavening agent used in each of the convenience products?
- Which leavening agent is used most often? Why?

These exercises provide students opportunities for reasoning and drawing conclusions based on information learned through the study of the effects of leavening agents on food products.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

3E- The student is expected to apply the principles of food preparation to preserve quality and nutritive value of foods.

1) BRAINSTORMING/CLASS DISCUSSION



Instruct students to get out pen and paper. Write the phrase, "Principles of Food Preparation" on the board and have students brainstorm what they consider those principles to be, especially based on what they have learned in Food Science and Technology so far. Display Teaching Aid 61a, **Principles of Food Preparation**, on the overhead projector and also distribute copies to students for their reference and study. Lead a class discussion over the principles of food preparation, clarifying information related to each principle through class discussion.

KEY QUESTIONS

- Why is selection of food important?
- What is meant by "preliminary treatment of food"?
- What factors influence the preservation of nutrients in food preparation and service?
- How are skills and the selection of recipes related to food product quality?
- Why is the manner in which food is served considered a principle of food preparation?

2) INDIVIDUAL ACTIVITY/SYMPOSIUM/TEAMWORK



Have students read Chapters 12 and 13 in the *Food Science and Technology Reference Book* or other references related to the principles of food preparation. Divide the students into four teams. Assign each team one of the following topics:

- Principles of protein cookery
- Principles of fruit and vegetable cookery
- Principles of carbohydrate cookery
- The use of fat in food preparation

Tell the class that they are going to have a "Food Preparation Symposium" to learn important information related to the principles of food preparation. Instruct the teams to use information from the *Food Science and Technology Reference Book* or other references to prepare their team's presentation for the symposium. Encourage students to use a variety of media and/or visual aids in their presentations.

If possible, videotape the presentations to use as a reteaching tool or for review by any students who were absent during the symposium.

3) CRITICAL THINKING

Have students complete the critical thinking activities described in Teaching Aid 61b, **Critical Thinking: The Principles of Food Preparation**. These

NOTES

TA 61a Principles of Food Preparation

SCIENCE

TAAS
READING

SCIENCE

TA 61b The Principles of Food Preparation

NOTESTAAS
READING

SCIENCE

TAs 7-10

Labs

SCIENCE



exercises provide students opportunities for reasoning, problem-solving, and drawing conclusions based on information learned through the study of the principles of food preparation.

4) LABORATORY EXPERIENCE

Divide students into laboratory groups. Have students research recipes (Internet search or cookbooks) for preparing potatoes using each of the following methods of preparation:

- baking (conventional and convection oven)
- roasting
- boiling
- steaming
- pressure cooking
- frying
- sautéing
- broiling
- microwave cooking
- stir fry

Determine which methods each laboratory group will use in their experiment. Have the students compare the appearance, texture, tenderness, and flavor of the cooked potatoes. Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

Student could choose to develop their own "Evaluation of Cooked Potatoes Scorecard" to use in assessing the cooked products.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 12 and 13.

WEB SITES

Aunt Edna's Kitchen

www.cei.net/~terry/auntedna/findrecipes/html

The Internet Chef On-line Magazine

www.ichef.com

Food Science and Technology

Knowledge and Skills.

(4) Nutrition and health.

The student uses knowledge of digestion and metabolism to establish lifelong habits of good nutrition and physical fitness.

The student is expected to:

- (A) describe the processes of digestion and metabolism;
- (B) explain basal and activity metabolisms and factors that affect each; and
- (C) apply knowledge of digestion and metabolism when making decisions related to food intake and physical fitness.

4A- The student is expected to describe the processes of digestion and metabolism.

1) VIDEOTAPE/CLASS DISCUSSION/INDIVIDUAL ACTIVITY

Have students view a videotape on digestion, such as *The Magic School Bus for Lunch, Topic: Digestion*. In addition, have students read Chapter 4 in the *Food Science and Technology Reference Book* on digestion and metabolism. Lead a class discussion on the digestive system and how it works. Discuss with students how nutrients serve as energy sources and play an important part in digestion and metabolism.

Display Teaching Aid 62a, *The Digestive System*, on the overhead projector and distribute copies to students. Through class discussion and student participation, trace food from the mouth through the digestive tract on the diagram giving specific details about each step of the process the functions of each part of the digestive system.

KEY QUESTIONS

- How does the body get nutrients from food?
- What is the function of saliva in the digestive process?
- What four organs are involved in the digestion of fats? (liver, gall bladder, pancreas, small intestine)

2) DEMONSTRATION

Share the following information with students prior to the demonstration: *Fat* is an essential nutrient and a concentrated energy source for the body. It supplies energy over a longer period of time than carbohydrates because it breaks down slowly. Too little fat in the diet can cause weight loss and failure to grow and develop properly. It can also cause an inability to absorb the fat-soluble vitamins A, D, E, and K. Too much fat in the diet causes weight gain and can lead to elevated cholesterol levels and heart disease.

Neither the mouth nor the stomach secrete specific enzymes to digest fat. Fats are digested in the small intestine by enzymes secreted from the pancreas. The following demonstration illustrates how fat is broken down so that it can be digested.

1. Mix a tablespoon of cooking oil into a full jar of water. The oil will accumulate on the top of the water. Mixing the combination will break the fat into many small globules, but the oil will not mix with the water.
2. Add two tablespoons of liquid soap and mix vigorously with a fork. What is the result?
3. The oil does not disappear, but breaks into many tiny globules, with the liquid soap in between the oil and the water.

NOTES

TA 62a-b
The Digestive System

SCIENCE

SCIENCE

NOTES

TA 63 *Laboratory Experiment: How Does the Body Use Food?*

TAs 7-10
Labs

SCIENCE



SCIENCE



The small intestines contain enzymes which cause a similar process in the digestion of fat. The fat is broken down into fine globules so that it can be further digested.

3) CLASS DISCUSSION/LABORATORY EXPERIMENT

Discuss with students the definitions of the following terms:

- *metabolism* - the processes by which nutrients are broken down to yield energy
- *basal metabolism* - the energy your body uses automatically for breathing, digestion, functions of body organs, building new cells, and maintaining normal body processes
- *activity metabolism or energy metabolism* - the energy your body uses above basal metabolism, such as the energy needed for physical activity

Divide students into laboratory groups. Distribute copies of Teaching Aid 63, *Laboratory Experiment: How Does the Body Use Food?*, and instruct students to follow the instructions. This experiment demonstrates how the breakdown of food by the digestive process enables food to be metabolized into energy. Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.



4) GROUP ACTIVITY/FCCLA

Have students prepare a skit or puppet show for elementary students explaining how the body converts food into energy and thus the importance of making wise food choices and maintaining a nutritionally-balanced diet.

FCCLA ACTIVITIES

- Power of One: A Better You
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 4.

4B- *The student is expected to explain basal and activity metabolisms and factors that affect each.*

1) CLASS DISCUSSION/ INDIVIDUAL ACTIVITY

Review with students the definitions of metabolism, basal metabolism, and activity or energy metabolism from Strategy 3 for TEKS 4A. Add the list of definitions *basal metabolic rate* or *BMR*. *Basal metabolic rate* is the amount of energy your body needs to support critical functions, such as breathing, regulation of body temperature, regulation of the heart-beat, and building and maintenance of cells.

Specialized equipment and testing procedures are needed for complete accuracy in determining basal metabolic rate (BMR). However, there is a mathematical formula that enables individuals to figure an approximation of the energy they need for basal metabolism.

Display Teaching Aid 64, *Calculating Your BMR*, on the overhead projector. Work through the example given with the students. Have students figure their own BMR using the formula given. Impress upon students that this figure represents the minimum amount of energy needed by their bodies just to sustain life, not including additional energy needed for walking, running, working, sports activities, etc. This is why an understanding of nutrition and the importance of making wise food choices is critical to achieving and maintaining good health throughout the life span.

2) CLASS DISCUSSION/WRITTEN EXERCISE

Distribute copies of Teaching aid 65, *Factors That Affect Basal Metabolic Rate*, to students. Review the information with the students. Have students complete the "Critical Thinking" exercise at the bottom of the page.

3) CLASS DISCUSSION/INDIVIDUAL ACTIVITY

Tell students that based on what they now know about figuring their BMR, they can more accurately determine the amount of energy (kilocalories) they individually need each day. The sum of the approximate number of kilocalories (measure of energy) needed for activities each day, the kilocalories needed for BMR, and an additional 10% needed for specific dynamic effect or SDE (the energy needed to digest food and absorb the nutrients from food) is equal to the total number of kilocalories needed to provide your body with the energy it needs and to maintain a constant weight. Display Teaching Aid 66, *Figuring Total Energy Needs*, on the overhead projector, and instruct students to use the information provided to figure their total energy needs.

NOTES

TA 64 *Calculating Your BMR*

TAAS
MATH

SCIENCE

TA 65 *Factors That Affect Basal Metabolic Rate*

SCIENCE

TA 66 *Figuring Total Energy Needs*

TAAS
MATH

SCIENCE

NOTES



KEY QUESTIONS

- What is the effect on energy metabolism of a major change in the level of activities?
- What is the effect on metabolism of severe weight loss, such as is common with eating disorders?
- What is the relationship of age and gender to an individual's BMR?
- Why is knowledge of total energy needs important?
- What might be the long-term effects of depriving the body of its energy needs?

FCCLA ACTIVITIES

- Power of One: A Better You
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 4.

4C- The student is expected to apply knowledge of digestion and metabolism when making decisions related to food intake and physical fitness.

1) CLASS DISCUSSION/CRITICAL THINKING

Set up a table in the front of the room with a selection of favorite snack foods, such as candy, chips, soft drinks, fruit, and crackers. Based on their new knowledge related to digestion and metabolism, lead students to discuss important factors to consider when making decisions related to food intake and physical fitness.

KEY QUESTIONS

- Which of the displayed foods would be appropriate for a student about to take an important test? Why?
- Which of these foods would be appropriate for an athlete to eat before a workout? Why?
- Why is physical activity important?
- Which of the foods displayed would be the most easily absorbed into the bloodstream? Why?
- How do emotions affect digestion and metabolism?

2) INDIVIDUAL ACTIVITY/GROUP ACTIVITY/VISUAL DISPLAY

Display Teaching Aid 67, *The Importance of Fiber to Digestion and Metabolism*, on the overhead projector. Review with students the definition of dietary fiber and its functions related to digestion and metabolism. Distribute copies of Teaching Aid 68, *Fiber in Your Diet*, to students and have them complete the matching activity. Review the correct responses with the class. Teaching Aid 68, *Fiber in Your Diet-Answer Key* is shown in the Notes column on the right. Next have students use the table on Teaching Aid 68 to plan a day's menu which would provide approximately 25 grams of fiber. Students should use Teaching Aid 17, *Food Guide Pyramid*, to assist them in planning their menus.

Collect all of the menus. Divide students into small groups. Randomly distribute the menus to the groups. Have the students evaluate the menus for fiber content and nutritional balance. Students could use nutrient data analysis software to analyze the menus, if available.

Tape a large sheet of butcher paper across the room. Have the student groups copy the "best" menus they evaluated onto the butcher paper. Lead a class discussion on the components of the menus that make them nutritionally balanced and beneficial to good health.

NOTES

SCIENCE

TA 67 *The Importance of Fiber to Digestion and Metabolism*

TA 68 *Fiber in Your Diet*

TA 68 *Fiber in Your Diet-Answer Key*

- | | |
|------|-------|
| 1. F | 6. J |
| 2. H | 7. B |
| 3. E | 8. D |
| 4. G | 9. C |
| 5. A | 10. I |

TA 17 *Food Guide Pyramid*

SCIENCE



BEST COPY AVAILABLE

NOTES



FCCLA ACTIVITIES

- Power of One: A Better You
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 4.

WEB SITE

American Dietetic Association
www.eatright.org

FitLife
<http://fitlife.com>

Food Science and Technology

Knowledge and Skills.

(5) Nutrition and health.

The student utilizes available technology to plan diets appropriate for long-term health and wellness.

The student is expected to:

- (A) plan diets appropriate to life cycle, activity level, culture, gender, and food budget;
- (B) develop examples of therapeutic diets;
- (C) explain consequences of eating disorders on long-term health;
- (D) devise strategies to deal with special dietary considerations including needs of women during pregnancy and lactation; and
- (E) utilize various guidelines and technology in evaluating diets.

5A- The student is expected to plan diets appropriate to life cycle, activity level, culture, gender, and food budget.

1) INDIVIDUAL ACTIVITY/TEAMWORK/COMPUTER EXERCISE



Have students read Chapter 5 in the *Food Science and Technology Reference Book* or other references regarding the effect of life span stage, activity level, culture, gender, and food budget to meal planning and dietary needs. Divide students into pairs or triads. Distribute copies of School Breakfast and School Lunch menus to students and copies of Teaching Aid 69, ***Planning Diets for Long Term Health and Wellness***. Have students use computer dietary analysis and nutrition assessment software to analyze the menus. It is important that students examine menus for a whole week or longer period as just looking at one day will not give as accurate an assessment. Tell students that they will need to use information learned from the reading, as well as information from the computer analysis, to completely analyze the appropriateness of the menus in regard to life span stage, activity level, culture, and gender.

KEY QUESTIONS

- How might the menus be modified for the various stages of the life cycle?
- How might the menus be modified for various activity levels of students, including teen athletes?
- How does culture impact food choices and daily dietary intake?
- How does gender impact food choices and daily dietary intake?
- How is the food budget related to daily diet, food choices, and nutritional needs?

2) GROUP ACTIVITY/CASE STUDIES



Divide students into small groups. Assign each group a case study from Teaching Aid 70, ***Menu-Planning Scenarios***. Have students plan a day's menus appropriate to life span stage, activity level, culture, gender, and food budget for the individual(s) in the case study. Students may wish to use the computer dietary analysis software to analyze the nutritional adequacy of their menus. Provide students with butcher paper or poster board to write their completed menus and display in the classroom. Have each group present their case study and menus to the class.

NOTES

TA 69 *Planning Diets for Long Term Health and Wellness*

TAAS
READING

SCIENCE



TA 70 *Menu-Planning Scenarios*

SCIENCE



NOTES



FCCLA ACTIVITIES

- Focus on Children: Prepare nutritious snacks for children
- Power of One: A Better You
- STAR Events: Applied Technology, Skills for Life
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 5.

COMPUTER SOFTWARE

The Diet Balancer, Nutridata Software Corporation (for purchase)
Analyzes diets for 26 nutritive components in over 3500 foods.

Nutrition and Menu Planner, Meridian Education Corporation (for purchase)
Allows users to plan daily menus by selecting foods from the Food Guide Pyramid. Analyzes nutritional values of each food selected.

WEB SITES

Dietary Analysis Program, USDA/Center for Nutrition Policy and Promotion
www.nal.usda.gov/fnic/foodcomp/

Food Finder
[www.olen.com/food](http://www olen.com/food)

Nutrition Analysis Tool, University of Illinois
www.ag.uiuc.edu/~food-lab/nat/

5B- The student is expected to develop examples of therapeutic diets.

1) INTERNET SEARCH/PROJECT/ORAL PRESENTATION



Define for students the term therapeutic diet. *Therapeutic diets* are prescribed by health professionals and are associated with the treatment of disease and disorders. Lead a class discussion about the use of these types of diets in the treatment of disease and disorders. Have students read Chapter 6 in the *Food Science and Technology Reference Book* or other references on diet-related diseases and disorders.

Divide students into "Internet Search Teams." Assign topics or let teams choose a topic; however, it is important that all topics are covered in the class. The following list suggest topics for student research:

- Diet and Cancer
- Diet and Diabetes
- Diet and Heart Disease
- Diet and Hypertension
- Diet and Obesity
- Diet and Osteoporosis

Distribute copies of Teaching Aid 71, *Project: The Relationship of Diet to Treatment of Disease*, to students to guide their information search. After students have completed all of the activities as directed on Teaching Aid 71, have them give an oral presentation to the class on the information learned through this experience.

KEY QUESTIONS

- What is the purpose of a therapeutic diet?
- Are therapeutic diets likely to cure a person of a disease or disorder? Why?
- What health conditions warrant a therapeutic diet?
- What factors do therapeutic diets have in common?
- What differences exist among common therapeutic diets?

2) GUEST SPEAKER



Invite a professional from the medical community (e.g., dietitians, nutritionists, nurses, doctors) to speak to the class about the use of therapeutic diets for individuals with such diseases and disorders as cardiovascular conditions, hypertension, diabetes, some cancers, and osteoporosis. Ask the speaker to bring examples of therapeutic diets to share with the students.

Following the presentation by the guest speaker, display an example of a one-day menu for an individual not on a special diet. As a group, have the students modify the one-day menu to make it appropriate for

NOTES

TA 71 *Project: The Relationship of Diet to Treatment of Disease*

SCIENCE



SCIENCE

NOTES

individuals on different therapeutic diets (i.e., diabetes, low fat/low cholesterol, low-sodium, etc.).

KEY QUESTIONS

- What is a therapeutic diet?
- How do therapeutic diets differ from a regular nutritionally-balanced diet?
- How is the need for a therapeutic diet determined?
- How are individuals educated about their prescribed therapeutic diet and good nutrition?
- What are the long term effects if individuals do not follow their prescribed therapeutic diet?



FCCLA ACTIVITIES

- STAR Event: Applied Technology
- Illustrated Talk

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 5 and 6.

WEB SITES

American Cancer Society
www.cancer.org
American Diabetes Association
www.diabetes.org
American Dietetic Association
www.eatright.org
American Heart Association
www.amhrt.org
Center for Disease Control and Prevention
www.cdc.gov
National Cancer Institute
www.cancernet.nci.nih.gov
National Health Information Center
nhic-nt.health.org
National Institutes of Health
www.nih.gov/health
National Osteoporosis Foundation
www.nof.org
U.S. Department of Health and Human Services
www.healthfinder.gov

5C- The student is expected to explain consequences of eating disorders on long-term health.

NOTES

TA 72 *Eating Disorders*

**TAAS
READING**

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Distribute copies of Teaching Aid 72, *Eating Disorders*, to students and instruct them to read carefully all of the information presented; include information presented in Chapter 6 of the *Food Science and Technology Reference Book* and additional reference information and articles on eating disorders if you choose. Lead students in a discussion of the following key questions.

KEY QUESTIONS

- What is the major cause of eating disorders?
- When did these disorders begin to appear in the population?
- Are men and women both affected by these disorders? How?
- What is the difference between anorexia nervosa and bulimia nervosa?
- Is it possible to have more than one disorder at the same time? How?
- How dangerous can eating disorders be to the individual?
- What are the symptoms of anorexia nervosa and bulimia nervosa?
- What are the health consequences of eating disorders?
- What is the treatment for each of these disorders?



2) GUEST SPEAKER OR VIDEOTAPE

Invite a guest speaker from the medical community (dietitian, nutritionist, nurse) to discuss eating disorders and their consequences on long-term health. As an alternative, have students view a videotape on eating disorders, short-term and long-term effects on health, and treatment options. Information on eating disorders also is available from many school counselors.

KEY QUESTIONS

- What are the major challenges faced by health professionals when diagnosing and treating eating disorders?
- What is the proportion of males to females with eating disorders? Why?
- What age of individuals have eating disorders?
- What are the long-term effects of eating disorders?
- What is the success rate of treatment for eating disorders?

NOTES**TAAS
READING****TAAS
WRITING****3) INDIVIDUAL ACTIVITY/RESEARCH/WRITTEN EXERCISE**

Assign students to write a fictitious story about a student with an eating disorder or research and report on a celebrity in the media who has had an eating disorder. The story or report should define the type of eating disorder, analyze the reasons individuals have this disorder, and suggest treatment options for those suffering from this disorder. Some celebrities who have had eating disorders include Jane Fonda, Tracy Gold, Sally Field, Karen Carpenter, and Cathy Rigsby.

FCCLA ACTIVITIES

- Power of One: A Better You
- STAR Events: Illustrated Talk; Skills for Life
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 6.

WEB SITES

Anorexia Nervosa and Related Eating Disorders, Inc.
www.anred.com/

National Eating Disorders Organization
www.kidsource.com/nedo/

National Health Information Center
nhic-nt.health.org

5D- The student is expected to devise strategies to deal with special dietary considerations including needs of women during pregnancy and lactation.

1) INDIVIDUAL ACTIVITY/CRITICAL THINKING

Have students review Chapters 5 and 6 in the *Food Science and Technology Reference Book* or other references related to special dietary considerations. Instruct students to keep a daily food record for themselves for three days. Have students evaluate the foods eaten using the guidelines for reducing the amount of fat in the diet found in the chapter. The use of computer dietary analysis software to analyze their food intake for the three-day period will be beneficial to students in this exercise. Instruct students to write alternate food suggestions to replace the high-fat foods in red or colored ink. Have student volunteers share their revised diets and tell which high-fat foods they are replacing.

2) INDIVIDUAL ACTIVITY/ORAL PRESENTATION



Have students number off from 1 to 7. Assign students the following nutrients based on their number (e.g., all the ones will read about protein):

- 1 = Protein
- 2 = Folate
- 3 = Vitamin B₁₂
- 4 = Calcium
- 5 = Phosphorus
- 6 = Magnesium
- 7 = Iron

Instruct students to read reference information on the relationship of their assigned nutrient to the health of women during pregnancy and lactation. Have students group themselves by number or nutrient. Instruct each group to report to the class the information about the critical importance of their assigned nutrient during pregnancy and lactation.

Distribute copies of Teaching Aid 73, *One-Day Menu for a Pregnant Woman*, to students, and have them complete the activity. Students will need the following teaching aids as reference material:

- Teaching Aid 17, *Food Guide Pyramid*
- Teaching Aid 74, *Recommended Dietary Allowances*
- Teaching Aid 75, *Dietary Reference Intakes*
- Teaching Aids 76a-c, *Food Composition Table*

Ask student volunteers to share their menus with the class, identifying the foods contributing the selected nutrients.

NOTES

TAAS
READING

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TA 17 *Food Guide Pyramid*

TA 73 *One-Day Menu for a Pregnant Woman*

TA 74 *Recommended Dietary Allowances*

TA 75 *Dietary Reference Intakes*

TA 76a-c
Food Composition Table

TAAS
READING

TAAS
MATH

SCIENCE



NOTES**TAAS
READING****SCIENCE****TAAS
WRITING****3) PROJECT**

Assign students or allow them to choose one of the following topics to research:

- Reducing Sugar in the Diet
- Targeting a Fiber-rich Diet
- Achieving a Low-fat Diet
- Sodium and Hypertension
- Milk Allergies, Lactose Intolerance, and Milk Intolerance
- Food Allergies
- Dietary Needs During Pregnancy and Lactation

Tell the students that they are going to write segments of a newspaper column titled, "Dear Dr. Diet." This column is one where individuals write in requesting information on a specific topic. Students must include strategies for dealing with the special dietary consideration they choose or were assigned. Have students use computer word processing programs to write their newspaper columns. Select one column on each topic to submit to the journalism teacher for publication in the school newspaper.

As an enrichment activity, have the FCCLA chapter write a column for each publication of the school newspaper dealing with health and wellness issues of interest to high school students.

FCCLA ACTIVITIES

- Power of One: A Better You
- STAR Event: Skills for Life
- Student Body

RESOURCES**BOOK**

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 5 and 6.

WEB SITES

American Academy of Pediatrics
www.aap.org

American Dietetic Association
www.eatright.org

Food Allergy Network
www.foodallergy.org

5E- The student is expected to utilize various guidelines and technology in evaluating diets.

1) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Food Guide Pyramid*, available from The Curriculum Center for Family and Consumer Sciences, or another video related to guidelines used in evaluating diets. Lead a class discussion on how these guidelines and computer dietary analysis provide consumers and professionals with tools for promoting, managing, and achieving nutritional health.

KEY QUESTIONS

- What are examples of dietary guidelines published by the United States government?
- Why does the government publish these guidelines?
- How are the guidelines used in the medical community?
- How are these guidelines used by educators?
- How are these guidelines used by consumers?
- How are the guidelines determined?
- What do you predict to be the long term results on the American population of the Food Guide Pyramid?

2) PROJECT

This is a multi-step project which provides students with opportunities to not only utilize dietary guidelines and technology in evaluating their own diets, but also to use these guidelines and technology to assess dietary habits of a sample of the school population, record and report the results of this assessment, and through class or FCCLA activities share valuable nutrition education information with the students in their school. Students also have the opportunity to develop a personal health and wellness plan.

1. Personal Food Recall and Dietary Analysis

Have each student keep a food record for three to five days. Instruct students to use a computer dietary analysis program (see RESOURCES) to evaluate the foods eaten during the reporting period. Distribute copies of Teaching Aid 16, *Nutrition and Your Health: Dietary Guidelines for Americans*, Teaching Aid 17, *Food Guide Pyramid*, Teaching Aid 74, *Recommended Dietary Allowances*, and Teaching Aid 75, *Dietary Reference Intakes* to students. Have students evaluate their food intake during the recall period based on the information provided in each of these guidelines. If computer dietary analysis programs are not available, have students use a Food Composition Table such as found on Teaching Aids 76a-c, or those found in the appendix of most nutrition textbooks and other nutrition references.

2. Survey of student population

Have students conduct a survey of the school student population

NOTES

TAAS
MATH

SCIENCE



TA 16 *Nutrition and Your Health: Dietary Guidelines for Americans*

TA 17 *Food Guide Pyramid*

TA 74 *Recommended Dietary Allowances*

TA 75 *Dietary Reference Intakes*

TA 76a-c
Food Composition Table

NOTES

TA 77 *Food Recall Form*

TA 78 *Activity Assessment*



BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 5.

VIDEOTAPE

Food Guide Pyramid, available from The Curriculum Center for Family and Consumer Sciences.

regarding their dietary habits and the recommendations of various dietary guidelines. Have students set up a booth near the school cafeteria for students to volunteer to participate in the survey. The Food Science and Technology students will distribute a **Food Recall Form** (such as Teaching Aid 77) with instructions and a return envelope for participating students to return their completed forms. FCCLA members might give apples to every student who returns a completed form. Surveys may be anonymous, or survey participants may write their name on the form so Food Science and Technology students can give the results back to them with ways they might modify their diets to follow the recommended guidelines (e.g., the Food Guide Pyramid).

3. Computer dietary analysis and compilation of results

Have the class perform computer dietary analysis on all of the completed student surveys and compile the results. Have students work in groups with varying responsibilities for the project, such as 1) enter data on the computer, 2) compile results, 3) chart and/or graph results, 4) write suggestions for students regarding food choices that follow the Food Guide Pyramid guidelines, and 5) prepare a visual display, showcase, poster, or brochure that reflects the results of the survey to inform the student population. One group might be in charge of publicity and take pictures and write articles for the school newspaper.

4. Evaluation

Have students complete an evaluation of the project using Teaching Aid 78, **Activity Assessment**, or another assessment tool that you provide. Lead a "debriefing" session with the students to discuss what was learned from the project and allow them opportunities to make recommendations for another semester.

FCCLA ACTIVITIES

- Power of One: Take the Lead; Speak Out for FCCLA
- STAR Events: Applied Technology; Chapter Service Project
- Student Body

RESOURCES

WEB SITES

Dietary Analysis Program, USDA/Center for Nutrition Policy and Promotion
www.nal.usda.gov/fnic/foodcomp/
Food Finder
[www.olen.com/food](http://www olen.com/food)
Nutrition Analysis Tool, University of Illinois
www.ag.uiuc.edu/~food-lab/nat/

Food Science and Technology

Knowledge and Skills.

(6) Nutrition and health.

The student evaluates resources in nutrition and food science.

The student is expected to:

(A) evaluate resources that provide reliable nutrition information; and

(B) propose ways to disseminate reliable nutrition information.

6A- The student is expected to evaluate resources that provide reliable nutrition information.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 17 in the *Food Science and Technology Reference Book* or other references related to sources of reliable nutrition information. Lead a class discussion on the wide scope of reliable and unreliable nutrition information available to consumers. This has become especially true with the ease of use and accessibility of the Internet.

KEY QUESTIONS

- What guidelines might help consumers determine if nutrition information is reliable?
- What are some ways that you use to determine the reliability of any type of information?
- How can this process be applied to accessing reliable nutrition information?

Display Teaching Aid 79, *Criteria for Determining the Reliability of Nutrition Information*, on the overhead projector. Review the criteria with students. Show students examples of reliable nutrition information sources, such as professional journals, local, state, and national health agencies, recognized health organizations, medical schools, and information disseminated by professional organizations such as the American Dietetic Association. Point out things to look for to assess credibility of the information or resource.

2) GROUP ACTIVITY



Divide the class into small groups. Give each group a nutrition information book, a nutrition journal, a newspaper article, magazine articles, or information from a Web site for the students to evaluate. Distribute copies of Teaching Aid 80, *The Truth of the Matter*, to students, and instruct them to complete the worksheet as the group evaluates the reliability of the nutrition information provided. Have each group share the results of their evaluation with the class.

3) CRITICAL THINKING

Have students research two organizations that provide nutrition information to the public. Resources for locating nutrition education organizations include the school and public libraries, the health department, or the county extension office. Students should identify and summarize programs and collect pamphlets or other publications provided by the organizations. Have students organize the data they collect in categories including information provided to the public, target audiences, services provided, accessibility, etc.

NOTES

TA 79 *Criteria for Determining the Reliability of Nutrition Information*

TAAS
READING

SCIENCE



TA 80 *The Truth of the Matter*

TAAS
READING

SCIENCE



TAAS
READING

SCIENCE



NOTES

KEY QUESTIONS

- What needs led to the formation of the organization?
- What is the organization's primary purpose or target audience?
- How can you or a family member benefit from the nutrition information provided by this organization?
- What might the future needs of this organization be in 25 years? 50 years? 100 years?

Have students share their findings and conclusions with the class. In this exercise, students collect data about two organizations that provide nutrition information to the public. In addition, students predict public need for nutrition information and ways it might be shared. This exercise provides students opportunities for reasoning, problem-solving, and drawing conclusions based on information learned about evaluating the reliability of nutrition information.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 17.

6B- The student is expected to propose ways to disseminate reliable nutrition information.

1) GUEST SPEAKER



Invite a dietitian, nutritionist, or nurse to speak to the FCCLA chapter or class on ways they can disseminate reliable nutrition information in the community, including ways chapter members and other students can contribute volunteer hours to organizations who work toward community education and public awareness of issues related to health.

Encourage students to plan and organize a chapter service activity to assist a community organization in disseminating reliable information to citizens.

2) BRAINSTORMING/PROBLEM SOLVING/ORAL PRESENTATION



Have students brainstorm different ways that information is given to the public. Examples include news articles and other print media, television, radio, presentations, etc. On a piece of notebook paper, have students rank order the methods listed; the method that they feel is most effective would be ranked #1 with the others in descending order. Compile the student rankings, and divide the students into groups based on the method they identified as most effective. For example, all the students who wrote "television" as #1 would be grouped together. If any group is too large (more than 4 students), divide the large group into two smaller groups.

Tell the students that their assignment is to use their #1 method to disseminate information to the public about the Food Guide Pyramid. For example, the student group who identified newspaper as their #1 method, would write a newspaper article about the Food Guide Pyramid. The group that selected television, would create a public service television spot on the Food Guide Pyramid, and so on. Have each group present their "creation" to the class.

3) ORAL PRESENTATION/FCCLA



Have chapter members plan, organize, and present a nutrition or food science lesson to a group of children and a lesson to a group of adults (such as PTA). The lesson for the children might emphasize making wise food choices or safety in the kitchen. The lesson for the adults might include information on meeting special dietary needs, food preparation techniques, meal planning, consumer food buying, reducing fat and cholesterol, reading food labels, or following the Food Guide Pyramid. Have students use Teaching Aid 78, **Activity Assessment**, as a tool for evaluating this experience.

NOTES



TA 78 Activity Assessment



NOTES



FCCLA ACTIVITIES

- Power of One: Take the Lead; Speak Out for FCCLA
- STAR Events: Chapter Service Project; Focus on Children

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 17.

Food Science and Technology

Knowledge and Skills.

(7) Food technology.

The student evaluates technologies used in food processing and product development.

The student is expected to:

- (A) summarize new research and trends.
- (B) assess methods of food processing and their impact on product quality and nutrition.
- (C) explain the roles of additives in food processing; and
- (D) contrast the effects of packaging on the properties and quality of the food and on the environment.

7A- The student is expected to summarize new research and trends.

1) INDIVIDUAL ACTIVITY/BRAINSTORMING/PROJECT



Have students read Chapter 8 in the *Food Science and Technology Reference Book* or other references related to new research and trends in food processing and product development. Lead a class brainstorming session having students identify topics related to new research and trends in food science and food technology. Some topics students might name include:

- genetic engineering
- robotics in food processing
- fat substitutes
- sugar substitutes
- salt substitutes
- food biotechnology
- organically-grown foods
- functional foods
- new technologies in food preparation tools and appliances
- meat analogues
- synthetic foods

Through newspaper, magazine, journal, and Internet searches, have students collect articles on new research and trends on the topics they identified or others as discussed in class. Have students set up a classroom file for organizing and maintaining their information. Encourage students to use, add to, and maintain this new classroom resource.

2) INDIVIDUAL ACTIVITY/CRITICAL THINKING EXERCISE

Write the following prompt on the board or transparency:

Futurists forecast American lifestyles in the twenty-first century to be fast-paced, career-oriented, and family-centered. Although both parents will be employed in most families, scheduling time for family activities will be a priority.

Instruct students to spend time thinking through each of the following questions, then respond to each question in writing. A multi-paragraph response is likely needed to answer the questions completely.

KEY QUESTIONS

- What challenges does this lifestyle present the food industry?
- What problems will arise for the food industry as consumer demands increase in the next 25 years?
- What new food trends do you predict will develop in the next 25 years?
- What role will food science and technology research play in meeting the demands of families in the 21st century?

NOTES

TAAS
READING

SCIENCE



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WRITING

SCIENCE

NOTES**SCIENCE****3) INDIVIDUAL ACTIVITY/PROJECT**

Outside of class, have students visit a local supermarket and write down all the examples of new research and trends in food processing and packaging that they can find. Instruct students to categorize the items based on their relation to new research and trends. Examples of items students might find include:

- packaged salads with green leaf and assorted vegetables
- ready-to-eat lunches and snacks for children and adults
- prepared casseroles
- "on-the-go" foods, such as yogurt in squeeze packaging
- special storage bags for extending life of fresh produce
- eggs with reduced cholesterol
- margarine that lowers HDL cholesterol
- bottled waters

Have each student share their findings with the class.

KEY QUESTIONS

- How recently have these products been added to the grocer's shelf?
- How do these products benefit the consumer?
- Would you buy these products? Why?
- How do these products relate to the family life-styles described in Strategy #2 above?

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 8.

WEB SITES

Center for Science in the Public Interest
www.cspinet.org

CNN

www.cnn.com/food/news

Food and Nutrition Information Center/USDA
www.usda.gov/fnic

Functional Foods for Health (University of Chicago)
www.ag.uiuc.edu/~ffh/ffh.html

Office of Biotechnology, FDA
www.fda.gov

7B- The student is expected to assess methods of food processing and their impact on product quality and nutrition.

1) CLASS DISCUSSION/INDIVIDUAL OR GROUP ACTIVITY



Display on a table food items that involve a variety of food processing methods. Examples include:

- Chemical preservation: pickles, spaghetti sauce, tomato juice, dried fruit, carbonated drinks, breads, deli meats, bacon.
- Aseptic packaging: ready-to-eat puddings, gelatin desserts, boxed juices
- Canning: any canned food product
- Refrigeration: milk and dairy products, cheese
- Curing: cured meat products
- Drying/Dehydration: dried fruits, raisins
- Fermentation: yeast bread, cheeses, yogurt, salami
- Freeze-drying: dehydrated onions and potatoes, instant soup mixes, instant coffee, instant oatmeal
- Irradiation: fresh strawberries, onions, and potatoes; fresh poultry
- Modified atmosphere: fresh apples, oranges, pears, grapes
- Pasteurization: milk, apple juice

Discuss the different products with students regarding the food processing methods that have made the food safe and acceptable to consumers. Have students review Chapter 8 in the *Food Science and Technology Reference Book* or other references related to food processing. Display Teaching Aids 81a-b, **Food Processing Methods**, or distribute to students as a handout. Briefly discuss what is meant by food processing and its importance to food product quality and safety.

Using copies of Teaching Aids 81a-b, cut apart the different methods listed until you have enough for each student to draw one. Have each student draw a food processing method from a basket and spend 20-30 minutes gathering information to "teach" the class about their method. Students who have the same method could do team teaching. Encourage students to be creative in developing strategies that will help their classmates remember the different methods and their purpose, such as flow charts, diagrams, etc. Sources of information on the different methods include: *Food Science and Technology Reference Book*; print and electronic encyclopedias; food science textbooks; and, reference materials on food processing and food preservation. County extension agents for Family and Consumer Sciences also can provide information on food preservation for students.

2) CRITICAL THINKING

Divide students into pairs. Assign each pair one or both of the following critical thinking exercises to complete.

- 1) Assume you are a food technologist associated with the National Aeronautics and Space Administration (NASA). You have a team of three product development specialists working with you to develop new food products for a space flight that will orbit the

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TA 81a-b

**Food Processing
Methods**

SCIENCE

**TAAS
WRITING**

SCIENCE

NOTES

SCIENCE

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 8 and 9.

VIDEOTAPE

Eating for Life, available from The Curriculum Center for Family and Consumer Sciences.

earth for three months. Today, each of your team members presents an idea for a new food for space travel. Describe these new products and evaluate them according to information you have learned about food for space. Consider all the factors listed in Chapter 8 of the *Food Science and Technology Reference Book* concerning development of food for space. Share the ideas for the new products and your critical evaluation of each one with your classmates.

- 2) Consider the effects of the various food processing methods and principles of food preservation on microorganisms that cause food spoilage. These food products have been left in the refrigerator for five days:

- an opened can of cream of potato soup
- a package of frozen spinach that has thawed
- a quart of reconstituted nonfat dry milk

Evaluate each of these foods to determine if microbial spoilage will have occurred. What principles of food preservation are involved? Explain why each of the foods may or may not be spoiled after five days.

These critical thinking exercises provide students opportunities to use problem-solving and reasoning skills, and to use complex thought processes in drawing conclusions and solving problems related to food processing and food preservation.

3) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students use their lists of food items from the supermarket gathered in Strategy #3 for TEKS 7A, or visit a supermarket and write down as many examples of differences in food processing (including packaging) that they can find. Have each student share their findings with the class. Lead a class discussion on the factors that may have led to the development of these products.

KEY QUESTIONS

- How many different methods of food processing were found by class members?
- What do you think led to the development of these products or their packaging?
- What will the supermarket of the future be like?
- What methods of food processing will be most common in 25 years?
- What changes in science, technology, and consumer demand will bring about advancements in food processing?

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Food Technology: Irradiation*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape on food processing methods. Lead a class discussion on information presented in the video.

7C- The student is expected to explain the roles of additives in food processing.

1) CLASS DISCUSSION/INDIVIDUAL ACTIVITY

Write the question, "What are food additives?" on the board or a transparency. Give each student a 3x5 index card and ask them to write on the card the answer to the question. Lead a class discussion with students on food additives and the beneficial role they play in providing consumers with a safe, high quality food supply. Discuss with students how misinformation and many misconceptions have led many individuals to have a negative reaction to the term, "additives."

Use Teaching Aid 82, **Functions of Food Additives**, to help students identify the many different functions food additives have. After discussing the difference between intentional food additives and incidental food additives, display Teaching Aid 83, **Intentional Food Additives**, on the overhead projector and discuss each of the categories of additives with the class.

Have students read and review Chapters 8 and 17 in the *Food Science and Technology Reference Book* or other references on the role of additives in food processing. Have students discuss key points presented in the chapters. As an additional activity, have students work in groups and examine food labels of items in the food science laboratory for various food additives.

KEY QUESTIONS

- What are food additives?
- What are the functions of food additives?
- What is the difference between intentional food additives and incidental food additives?
- What are the Food and Drug Administration regulations on food additives?
- What is the importance of these regulations?

2) DEBATE



Divide the class into debate teams. (A typical debate team would have three to five members; however, additional students may be added to the debate team to research and organize information while others prepare for the actual debate.) Have the teams debate the following issue:

- *The Delaney Clause should be abolished.*

Distribute copies of Teaching Aid 84, **Guidelines for a Classroom Debate**, to students. Review the procedures with the class being sure that students understand the difference between a debate, a discus-

NOTES

TA 82 **Functions of Food Additives**

TA 83 **Intentional Food Additives**

TAAS
READING

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TA 84 **Guidelines for a Classroom Debate**

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NOTES



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sion, and a disagreement. Students will need to research information to present their point of view. At the conclusion of the debate, ask student volunteers to summarize important points presented by both sides.



3) SKIT/ROLE PLAY/LISTENING TEAMS

Have students present a television "talk show" and have the "host" interview different food additives. Assign different additives to students or have them draw to determine which additive they will "role play." Select a host and director for the television show. Use listening teams in the audience to review the class on the information presented at the end of the presentation or at the beginning of the next class period.

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Food: Fact or Fiction*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape on food additives. Lead a class discussion on information presented in the video.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapters 8 and 17.

VIDEOTAPE

Food: Fact or Fiction, available from The Curriculum Center for Family and Consumer Sciences.

WEB SITES

Center for Science in the Public Interest
www.cspinet.org

Food and Drug Administration
www.fda.gov

Food and Nutrition Information Center/USDA
www.usda.gov/fnic

7D- The student is expected to contrast the effects of packaging on the properties and quality of the food and on the environment.

1) INDIVIDUAL ACTIVITY

In preparation for the educational tour and presentation by the supermarket manager, have students read the sections on food packaging found in Chapter 8 in the *Food Science and Technology Reference Book* or read other reference material on food packaging and new technologies in this area of the food industry.

KEY QUESTIONS

- What is the role of food packaging in food processing?
- What factors must the food manufacturer consider when selecting the appropriate type of food packaging for food products?
- What are examples of some recent innovations and new technologies in food packaging?

2) EDUCATIONAL TOUR/GUEST SPEAKER



Arrange for students to take an educational tour of a supermarket where the store manager can show examples of and explain the new technologies in food packaging and the effects of food packaging on the quality and shelf life of the food items. Have the store manager show the students many different kinds of food packaging, or have the students walk through the store and list examples of different types of packaging. Examples students should look for include:

- aseptic packaging
- perforated film bags which control moisture loss for produce
- plastic bags which can be boiled
- heat-resistant plastics and paper suitable for microwave use
- combination of materials used in packaging
- edible films, such as sausage casings and those used on fruits and vegetables

After returning to school, review with students the different types of packaging they viewed and what they learned about current trends in food packaging. Distribute two copies of Teaching Aid 85, ***Compare and Contrast Types of Food Packaging***, to each student. Instruct students to write "The Effects of Packaging on Food Products" in the blank provided on one, and "The Impact on the Environment" in the blank provided on the other. Instruct students to select two different types of food packaging they learned about from the supermarket tour and complete the worksheet by comparing and contrasting the similarities and differences in the two types in relation to their effect on the food product and their impact on the environment.

Have students share their diagrams with the class.

NOTES

TAAS
READING

SCIENCE

TA 85 *Compare and Contrast Types of Food Packaging*

SCIENCE



NOTES

KEY QUESTIONS

- What is the purpose of each type of packaging?
- How do the different types of packaging impact the retail cost of the product?
- How is the quality of the food product affected by each type of packaging?
- Which types of packaging have been introduced to the United States retail grocer in the last five years?
- What need or consumer demand brought about the development of these new packaging materials or new technologies?
- What advancements in food packaging do you predict for the next 25 years?
- What factors of American society are likely to influence these advancements?

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 8.

WEB SITES

Center for Science in the Public Interest
www.cspinet.org

Food and Drug Administration
www.fda.gov

Food Science and Technology

Knowledge and Skills.

(8) Food technology.

The student evaluates safety and sanitation standards.

The student is expected to:

- (A) describe properties of microorganisms that cause food spoilage and food-borne illness.
- (B) outline sanitation and food-handling practices that can help prevent food contamination and food-borne illness;
- (C) describe functions of government agencies that regulate food quality, wholesomeness, and safety; and
- (D) analyze industry quality control standards and skills related to safety and safe working conditions.

8A- The student is expected to describe properties of microorganisms that cause food spoilage and food-borne illness.

1) CLASS DISCUSSION/SCENARIOS



Have students read Chapter 9 in the *Food Science and Technology Reference Book* or other resources on safety and sanitation to gain background information on principles of food safety and its importance.

KEY QUESTIONS

- What is a food-borne infection?
[an infection caused by eating food containing harmful microorganisms]
- What is a food-borne intoxication?
[an illness caused by poisons or toxins in the food a person eats. The toxin may occur naturally in the food, as in certain mushrooms, or the food may be contaminated by toxins produced by certain microorganisms.]

Display Teaching Aid 86, *Types of Microorganisms*, on the overhead projector. Discuss the four types and their impact on food safety. Distribute copies of Teaching Aid 87, *Scenarios: The Growth of Microorganisms*, to students. Have them work individually to write responses to the scenarios.

2) GROUP ACTIVITY/BROCHURES



Divide students into small groups. Instruct each group to develop a consumer information brochure regarding food safety and sanitation in the prevention of food spoilage and food-borne illness. Student brochures should answer the what, when, where, why, and how regarding the different types of microorganisms associated with food spoilage and food-borne illness. Have students use computer word processing and desktop publishing programs to produce their brochures.

Use Teaching Aids 88a-b, *Brochure Assessment*, as a tool for evaluating the students' work.

3) LABORATORY EXPERIENCE

Review with students information about molds including the following points:

- Molds are fungi that may or may not be harmful to humans.
- Molds are furry-looking fungi that can grow on almost any food at almost any storage temperature, under almost any conditions - moist or dry, acid or nonacid, salty, or sweet.
- The color of mold is usually white but also can be blue-green, orange, black, gray, or even red.
- Certain molds produce toxins that have been known to cause

NOTES

TA 86 *Types of Microorganisms*

TA 87 *Scenarios: The Growth of Microorganisms*

TAAS
READING

SCIENCE

TA 88a-b
Brochure Assessment

TAAS
READING

SCIENCE



TA 89 *Laboratory Experiment: Molds*

TAs 7-10 *Labs*

SCIENCE

NOTES

- cancer in animals.
- Food items with mold spots should be discarded.
- Freezing prevents the growth of molds, but does not kill those already present in food.
- Some molds give a musty odor and flavor to foods.
- Some people have allergies to certain molds. These allergies affect the sinuses, eyes, ears, and respiratory tract.

Divide students into laboratory groups. Have students conduct the experiment on Teaching Aid 89, **Laboratory Experiment: Molds**. Following this activity, have students evaluate their use of appropriate laboratory knowledge and skills in conducting this experiment.

Please refer to page 17 of this section for information on planning, conducting, and evaluating laboratory experiences.

SCIENCE

4) VIDEOTAPE

Have students view a videotape on microorganisms that cause food spoilage and food-borne illness, such as *Understanding Food-borne Pathogens*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape of your choice. Lead a class discussion on these microorganisms, why they cause food-borne illness, and the importance of following food safety guidelines in the home and in commercial foodservice.



FCCLA ACTIVITIES

- STAR Events: Illustrated Talk; Skills for Life

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 9.

VIDEOTAPE

Understanding Food-borne Pathogens, available from The Curriculum Center for Family and Consumer Sciences.

8B- The student is expected to outline sanitation and food-handling practices that can help prevent food contamination and food-borne illness.

1) GUEST SPEAKER



Invite the school district dietitian or cafeteria manager to speak to the class about food safety, sanitation, and food-handling practices that help prevent food-borne illness. Have the speaker discuss food safety guidelines practiced and enforced in commercial foodservice.

KEY QUESTIONS

- How are food safety guidelines and food-handling practices enforced in commercial foodservice?
- Who is responsible for ensuring that foodservice employees follow these guidelines and practices?
- What food-handling practices are of critical importance for the home kitchen? Why?

Following the presentation, have students write a one page summary of information learned from the presentation.

2) VIDEOTAPE

Have students view a videotape on food safety and food-handling practices, such as *Food Safety: Would Your Kitchen Pass Inspection?*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape of your choice. Lead a class discussion on the food safety guidelines and food-handling practices discussed in the video and the importance of following food safety guidelines and food-handling practices in the home and in commercial foodservice.

3) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read resources from the classroom, school library, or Internet on proper food storage temperatures and on selecting appropriate thermometers for monitoring cold food storage including information found in Chapter 9 of the *Food Science and Technology Reference Book*. Teaching Aids 90a-b, **Food Storage Guidelines**, can be used as student references or transparencies for classroom discussion. Distribute copies of Teaching Aid 91a, **Temperature of Food for Control of Bacteria Worksheet**, for students to record information learned in the readings. Display Teaching Aid 91b, **Temperature of Food for Control of Bacteria**, and review with students the proper temperatures for safe food storage and the "Danger Zone." Allow students to use information from the transparency to complete their worksheets, if necessary. Have students mark the "Danger Zone" on the thermometer.

NOTES

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SCIENCE

TA 90a-b

*Food Storage
Guidelines*

TA 91a *Temperature of
Food for Control
of Bacteria
Worksheet*

TA 91b *Temperature of
Food for Control
of Bacteria*

SCIENCE

NOTES



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KEY QUESTIONS

- How long can prepared food be safely left at room temperature?
- What is the temperature danger zone for bacterial growth?



4) INDIVIDUAL ACTIVITY/VISUAL DISPLAY

Have students use computer graphics programs or art supplies to create a small poster or checklist to be disseminated to consumers in the community and used in the food science laboratory on food safety and sanitation. Have students display their completed posters/checklists in the classroom, and have the class members evaluate each poster/checklist for accuracy of information, readability, clarity, design, and effectiveness.

5) WRITTEN EXERCISE

Have students write a letter to a friend or family member who has just begun living independently on the importance of knowledge and skills related to food safety and sanitation. Have students exchange letters and write a reply to the sender acknowledging the usefulness of the information.

FCCLA ACTIVITIES

- STAR Events: Chapter Service Project; Illustrated Talk; Skills for Life
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 9.

VIDEOTAPE

Food Safety: Would Your Kitchen Pass Inspection?, available from The Curriculum Center for Family and Consumer Sciences.

WEB SITES

American Dietetic Association
www.eatright.org

Food and Drug Administration
www.fda.gov

Food and Nutrition Information Center/USDA
www.usda.gov/fnic

Partnership for Food Safety Education
www.fightbac.org

Texas Department of Health
www.tdh.texas.gov/

8C- The student is expected to describe functions of government agencies that regulate food quality, wholesomeness, and safety.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students review Chapter 9 in the *Food Science and Technology Reference Book* or other references on agencies that regulate the food industry. Lead a class discussion on the importance of quality control standards to the safety of the food supply and consumer confidence in the safety of commercial foodservice.

KEY QUESTIONS

- What are checks and balances?
- Why are quality control standards important in the food industry?
- What are the consequences of failure to adhere to quality control standards?

2) SYMPOSIUM

Divide students into teams. Have each team research an organization which regulates food sanitation, food safety, or safe working conditions for the food industry, such as:

- Texas Department of Health (www.tdh.tx.gov/);
- Food and Drug Administration (FDA) (www.fda.gov/);
- Environmental Protection Agency (EPA) (www.epa.gov/);
- Texas Natural Resource Conservation Commission (www.tnrcc.state.tx.us);
- United State Department of Agriculture (USDA) (www.usda.gov); or,
- Occupational Health and Safety Administration (OSHA) (www.osha.gov/).

Students should search for information that identifies regulations, quality control standards, policies, and procedures used to oversee food quality and wholesomeness, and employee safety in food industries in the United States. Have students organize their information to be presented to the class in a symposium format. Student presentations should answer the following questions:

- When was the agency established?
- What factors led to the development of this agency?
- What are its primary responsibilities?
- What laws or ordinances is this agency responsible for enforcing?
- Why are these quality control standards or safety measures important?

After all of the presentations, have student volunteers summarize what was learned about the different agencies.

KEY QUESTION

- Why is this information important for you to know?

NOTES

TAAS
READING

SCIENCE

SOCIAL
STUDIES

TAAS
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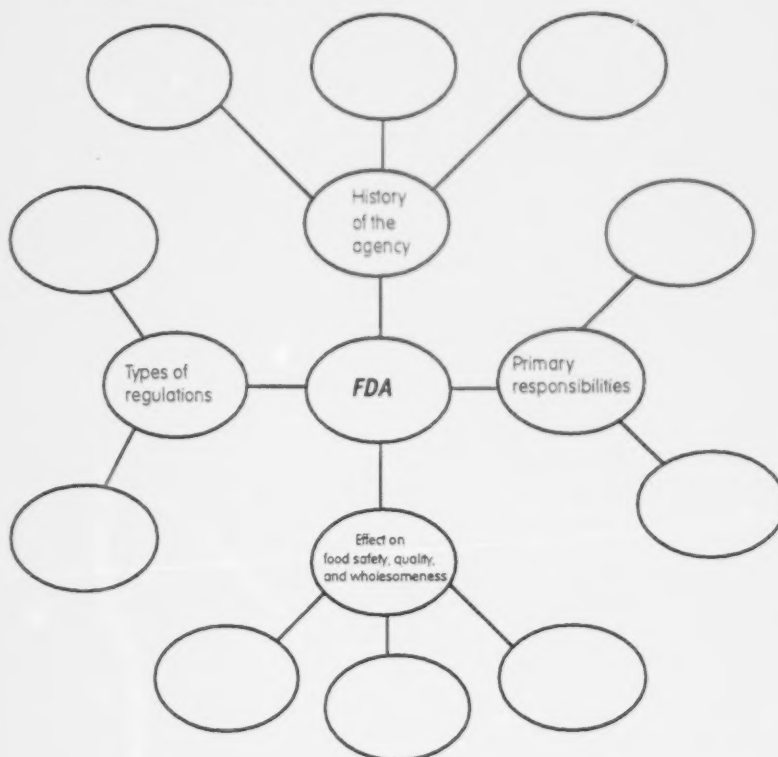
SCIENCE

SOCIAL
STUDIES



NOTES**TA 38 Web Diagram****SOCIAL
STUDIES****3) WEB DIAGRAM**

As a reteaching tool, review tool, or method of organizing information presented during the symposium, have students create web diagrams for each of the agencies discussed during the symposium. An example of a web diagram is shown on Teaching Aid 38, *Web Diagram*, or may resemble the following:



After students have completed their diagrams, review the key points with the class.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 9.

8D- The student is expected to analyze industry quality control standards and skills related to safety and safe working conditions.

1) CLASS DISCUSSION/VIDEOTAPE

Display Teaching Aid 92, *The Hazardous Analysis Critical Control Point (HACCP) System of Classification*, on the overhead projector. Lead a class discussion about HACCP and its importance to the food industry. Have students view the videotape, *HACCP: A Basic Understanding*, available from the The Curriculum Center for Family and Consumer Sciences or another videotape that explains HACCP. Discuss with students the importance of quality control standards in the food industry.

KEY QUESTIONS

- What is HACCP?
- How is it used in the food industry?
- How do these standards serve to "protect" the food industry?

2) EDUCATIONAL TOUR

Arrange for students to take an educational tour to a restaurant, food processing plant, flour mill, grocery store, or institutional kitchen to observe facilities which maintain quality control standards and require employees to have skills related to safety and safe working conditions. Ask a representative of the operation to explain the quality control measures that they follow and types of safety training given to employees both on food safety and safe working conditions.

Upon returning to school, have students write a one page summary or reaction paper about the educational tour.



3) GROUP ACTIVITY/INTERNET ACTIVITY

Divide students into small groups. Distribute copies of Teaching Aid 93, *Analyzing Quality Control Standards for the Food Industry*, to students. Instruct students to search the Internet for examples of standards and regulations enforced by the agencies listed. After students have gathered examples of standards and regulations, have them work together in their group and discuss the purposes of the regulations, whether or not these regulations should continue to be enforced, and why. After all groups have completed their work, have a representative from each group share their analysis of the regulations with the class and identify the Web sites where they located their information.

NOTES

TA 92 *The Hazardous Analysis Critical Control Point (HACCP) System of Classification*

SCIENCE

TAAS
WRITING

SCIENCE



TA 93 *Analyzing Quality Control Standards for the Food Industry*

SCIENCE



NOTES

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 9.

VIDEOTAPE

HACCP: A Basic Understanding, available from The Curriculum Center for Family and Consumer Sciences.

WEB SITES

Food and Drug Administration
www.fda.gov

Food Safety
www.foodsafety.gov/

Texas Department of Health
www.tdh.texas.gov/

Food Science and Technology

Knowledge and Skills.

(9) Food technology.

The student differentiates the effects of technology on nutrition, the food supply, marketing, and distribution.

The student is expected to:

- (A) determine the effects of technological advances on food availability;
- (B) interpret how consumer choice is influenced by market research and marketing in the field of food science and nutrition;
- (C) summarize the relationship of entrepreneurial opportunities, technological advances, and marketing research; and
- (D) determine the effects of advancements in food science and technology on family strengths and the welfare of family members.

9A- The student is expected to determine the effects of technological advances on food availability.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 16 in the *Food Science and Technology Reference Book* or other references on the effects of technological advances on food availability. Have students discuss key points presented in the chapter.

2) CLASS DISCUSSION/RESEARCH/GROUP ACTIVITY



Display Teaching Aid 94, **Definitions: Food Science and Food Technology**, on the overhead projector. Discuss with students the difference in the two terms. As students search resources for articles on technological advances that affect food availability, it is important that they understand the difference between an advancement in food science (research related to food chemistry, nutrition, microbiology of food, etc.) and food technology (research and innovations related to the application of technologies that make food products safe and acceptable for consumption). Have students collect current articles from magazines, newspapers, research journals, and Internet resources related to advances in food technology that affect food availability.

Arrange the chairs or student desks in a circle, and have students briefly report on the information presented in the articles they read.

KEY QUESTIONS

- What advancements in food technology have impacted food availability in the United States in the past 10 years?
- What advancements in food technology have impacted food availability in other parts of the world in the past 10 years?
- Why does the United States lead other countries in the world in food technology research?
- Why is this type of research important?
- Specifically, how can these advancements positively impact food availability around the world?
- How can these advancements negatively impact food availability?
- What are past advancements in food technology that have increased food availability?

Teaching Aid 94a, **The Effects of Technological Advances on Food Availability**, can be used as an individual student worksheet or as a recording tool for information learned from student presentations. Have students file their articles in the class resource file they created in Strategy #1, TEKS 7A.

3) GUEST SPEAKER/LISTENING TEAMS



Invite the county agricultural extension agent to speak to the class about new developments in agriculture that impact food availability.

NOTES

TAAS
READING

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TA 94 **Definitions: Food Science and Food Technology**

TA 94a **The Effects of Technological Advances on Food Availability**

TAAS
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SCIENCE

NOTES

especially in relation to agricultural products produced in the local area. Have students prepare questions for the speaker prior to the presentation. Divide students into listening teams, and assign each team segments of the presentation to record and review with the class during the following class period.

KEY QUESTION

- How does area agriculture affect food availability for consumers in this community?

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 16.

WEB SITES

Institute of Food Science and Technology

www.ifst.org/

Institute of Food Technologists

www.ift.org/

Internet Public Library

www.ipl.org

United States Department of Agriculture

www.usda.gov/

Virtual Reference Desk

www.refdesk.com

9B- The student is expected to interpret how consumer choice is influenced by market research and marketing in the field of food science and nutrition.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read the sections on marketing in Chapter 16 in the *Food Science and Technology Reference Book* or other resources. Lead a class discussion on food marketing asking student volunteers to share their reactions to food marketing techniques utilized in print, radio, television, and electronic media.

KEY QUESTIONS

- How did the advertisement get your attention?
- What information presented was relevant to you?
- What factors most influenced you to want to try the product?
- How is marketing research related to advertising?
- Why is market research important to the food industry?

2) SKIT

Assign two students to perform the skit on Teaching Aids 95a-b, *Interview of the Week*. If time permits, encourage students to add additional questions to the script. The skit is an interview between a television news anchor and a food marketing researcher. Have the actors field questions from the "audience" after the interview.

3) VISUAL DISPLAY



Using a variety of magazines, have students collect examples of food marketing techniques and create a collage of their examples. The examples can include any advertisement or marketing tactic for food products or services (such as restaurants, coupons, etc.). Post the collages around the classroom.

Distribute copies of Teaching Aid 96, *How Consumer Choices are Influenced by Marketing Techniques*, to students. Assign each student four different collages to evaluate (other than their own) using Teaching Aids 95a-b to record their responses. After all students have completed their evaluations, lead a class discussion having students share their reactions to the different marketing techniques.

NOTES

TAAS
READING

TA 95a-b

Interview of the Week

TA 96 *How Consumer Choices Are Influenced by Marketing Techniques*

NOTES



FCCLA ACTIVITIES

- Financial Fitness: Consumer Clout
- Power of One: A Better You

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 16.

9C- *The student is expected to summarize the relationship of entrepreneurial opportunities, technological advances, and marketing research.*

1) INDIVIDUAL ACTIVITY/WRITTEN EXERCISE

Have students research an individual who is an entrepreneur associated with food science, food technology, or nutrition in the food industry. Resources include the Internet, school library, public library, and magazine and newspaper articles. Examples of some entrepreneurs include Colonel Harland Sanders, Dave Thomas, Debbi Fields, Ray Kroc, Clarence Birdseye, Orville Redenbacher, Julia Child, Jane Brody, and Marie Callender. There are many others. Encourage students to recall media publicity associated with food industry entrepreneurs.

Have students write a summary of their research and share their findings with the class.

KEY QUESTIONS

- What is the relationship of the entrepreneur to technological advances and marketing?
- How has each entrepreneur impacted the food industry?

2) INTERVIEW OR GUEST SPEAKER



Have students interview an entrepreneur in the community who is associated with the food industry (restaurateur, bakery owner, butcher, caterer, etc.). As a class, prepare a set of interview questions to be used in the interview.

As an alternative, invite the entrepreneur to speak to the class in a dialogue format. This is an informal arrangement, and the students should have questions prepared for the speaker to respond to.

NOTES

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FCCLA ACTIVITIES

- FCCLA Career Connection: PLUG IN to Careers
- Financial Fitness: Financing Your Future
- Power of One: Working on Working
- STAR Event: Entrepreneurship

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 16.

9D- *The student is expected to determine the effects of advancements in food science and technology on family strengths and the welfare of family members.*

1) PANEL DISCUSSION



Invite an older adult or a panel of older adults to speak to the class on advancements in food science and technology that have affected the family. Ask panel members to share with students information regarding the food supply, food preparation, food abundance, and characteristics of "family mealtime" from their childhood and young adulthood. In advance of the presentation, discuss with students what information they would like to learn about the impact of technological advancements in the food industry on families.

2) BRAINSTORMING/CLASS DISCUSSION



Divide students into three groups for this "round robin" activity. Write each of the following questions on a separate sheet of paper. Begin by giving Question 1 to Group 1, Question 2 to Group 2, and Question 3 to Group 3. Ask each group to brainstorm together and write a response to their question. Then have Group 1 pass Question 1 to Group 2, Group 2 pass Question 2 to Group 3, and Group 3 pass Question 3 to Group 1. Each group then responds to the next question on the appropriate paper. Finally, have Group 1 pass Question 3 to Group 2, Group 2 pass Question 1 to Group 3, and then Group 3 pass Question 2 to Group 1. After the exchanges, each sheet should have a written response from each group.

- Question 1: What technological advancements in the food industry (including appliances and equipment) have simplified food preparation tasks for individuals in special circumstances, such as older adults, persons with disabilities, latchkey children, others in self-care, etc.?
- Question 2: How have food preparation tasks been impacted by technological advancements in packaging, processing, and preservation of food products?
- Question 3: How have technological advancements in the food industry impacted family strength and welfare of family members?

Have a student volunteer from each group read the responses from their last question. Point out the differences in the responses based on which question the group answered first.

KEY QUESTION

- What are the effects of advancements in food science and technology on family strengths and the welfare of family members?

NOTES

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STUDIES

SCIENCE

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STUDIES

NOTES**SOCIAL
STUDIES**

TA 97 *The Impact of
Advancements in
Food Science and
Technology on
Family Strengths
and Welfare of
Family Members*

**3) VISUAL DISPLAY/ CLASS DISCUSSION**

Display a variety of old cookbooks, antique reproduction catalogs, and photographs or magazine pictures of "vintage" kitchens. The school librarian may be able to assist with locating resources with these kinds of pictures. The public library also is a good resource. Allow students time to look through the various books and pictures. Lead a class discussion on how technology has impacted the home kitchen, food preparation tasks, and family mealtime.

4) WEB DIAGRAM/CRITICAL THINKING

Distribute copies of Teaching Aid 97, *The Impact of Advancements in Food Science and Technology on Family Strengths and Welfare of Family Members*, to students. Considering previous information learned on advancements in food science and technology, have students complete the web diagram as they think through the implications (positive and negative) that these advancements have on families. Lead a class discussion having students share their conclusions. If possible, make transparencies of the students' completed web diagrams, and have students explain their diagrams to the class.

FCCLA ACTIVITIES

- Families First: Families Today; You-Me-Us; Meet the Challenge
- Power of One: Family Ties
- STAR Events: Illustrated Talk; Skills for Life

RESOURCES**BOOK**

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 16.

Food Science and Technology

Knowledge and Skills.

(10) Food technology.

The student utilizes research skills in conducting and evaluating scientific research in food science.

The student is expected to:

- (A) analyze various research methods used in food science, technology, and nutrition;
- (B) describe ways to choose topics for research in food science, technology, and nutrition;
- (C) evaluate research projects related to a current issue in food science, technology, and nutrition; and
- (D) utilize research methods to create projects related to a current issue in food science, technology, and nutrition.

10A- The student is expected to analyze various research methods used in food science, technology, and nutrition.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 18 in the *Food Science and Technology Reference Book* or other references on research methods used in food science, food technology, and nutrition. Have students discuss key points presented in the chapter.

2) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Display Teaching Aid 98, *Nutrition Research*, on the overhead projector, or distribute copies to students to read individually. Lead a class discussion about different research methods used in food science, food technology, and nutrition.

KEY QUESTIONS

- What were the hypotheses of these early researchers?
- What research methods did they use?
- How might these same hypotheses be tested today?
- What types of research have you heard about via audio, video, electronic, or print media?
- What was the topic of the research?
- What research methods were used?

3) TEAMWORK



Divide students into pairs or triads, assigning each team a letter, such as "Team A, Team B," etc. Write the following list of research terms on a large sheet of butcher paper taped across the front of the classroom. Leave enough space after each term for team members to write definitions. Have each team search print references and the Internet for definitions and write the definition on the butcher paper and label with their team name, e.g., Team A, Team B, and so on. The team that accurately defines the most terms is the winner. Have team members read their written definitions and explain the term to the class. Remind students that the definition must be a clearly understood explanation of the term. If one team disagrees with another team's definition, they may write their challenging definition below it. The teacher will be the judge of the accuracy of the definitions. Emphasize to students how an understanding of the vocabulary used in research articles and reports facilitates an understanding of the work that was conducted. Suggested terms include:

- assumption
- blind experiment
- control group
- double-blind experiment
- experimental group

NOTES

TAAS
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SCIENCE

TA 98 *Nutrition
Research*

TAAS
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SCIENCE



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SCIENCE

- follow-up study
- human subject
- limitation
- pilot study
- randomization
- reliability
- research

- review of literature
- sampling
- statistic
- survey
- test
- validity
- variable



4) GUEST SPEAKER

Invite a science teacher to speak to the class on various research methods used in the many fields of science and how research methods are determined based on the research question and hypothesis. Have students share with the speaker topics of research in food science, food technology, and nutrition that have been discussed in class, and have the speaker discuss with students the research methods that might have been used for these projects.

4) VIDEOTAPE/CLASS DISCUSSION

Have students view the videotape, *Online Safety*, available from The Curriculum Center for Family and Consumer Sciences, or another videotape on appropriate use of the Internet. Lead a class discussion on information presented in the video.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 18.

VIDEOTAPE

Online Safety, available from The Curriculum Center for Family and Consumer Sciences.

WEB SITES

Dictionaries

www.onelook.com

Internet Public Library

www.ipl.org

Look Smart

www.looksmart.com

Merriam Webster Dictionary

www.m-w.com/dictionary

Science Surf

www.weber.u.washington.edu/~wcalvin/scisurf.html

Virtual Reference Desk

www.refdesk.com

10B- The student is expected to describe ways to choose topics for research in food science, technology, and nutrition.

1) GROUP ACTIVITY/CLASS DISCUSSION



Have students read Chapter 18 in the *Food Science and Technology Reference Book*. Bring a collection of newspapers and magazines (including those related to health, family issues, issues related to health and welfare of people in war-torn and underdeveloped countries, etc.) for students to use. Have students peruse the periodicals and make a list of issues that could become research topics. Lead a class discussion on the students findings and based on the following key questions.

KEY QUESTIONS

- How are topics for research in food science, technology, and nutrition related to personal need, personal interest, societal need, government need, community need, or industry request?
- What needs or issues do you think will be springboards for research in the fields of food science, food technology, or nutrition in the 21st century?
- What is learned from research?
- How do researchers choose topics?
- Why is research needed in the fields of food science, food technology, and nutrition?

2) INTERVIEW

Have students interview each one of their teachers to learn a research topic that the teacher feels is needed in his or her area of study. Assist students in wording one or two questions to use in soliciting this information from faculty members. Have students share their findings with the class.

3) LIBRARY PROJECT

Have students select a topic in food science, food technology, or nutrition and use library resources and the Internet to determine the availability of resources and reference material on their topic. Have the librarian speak to the class on techniques for locating information on their topic. Discuss with students their chosen topics and reference information they found on their topic.

KEY QUESTIONS

- What types of background information do researchers need when beginning a new research project?
- What happens if they are unable to locate sufficient background information?
- If you were unsuccessful in locating information on your topic, where else might you look for information?

NOTES

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RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 18.

WEB SITES

The Electronic Library

www.elibrary.com

www.newstrawler.com

Internet Public Library

www.ipl.org

The Library of Congress

www.locweb.loc.gov

Look Smart

www.looksmart.com

The Mining Company

<http://miningco.com>

Research It!

www.itools.com/research-it/research-it.html

Science Surf

www.weber.u.washington.edu/~wcalvin/scisurf.html

Virtual Reference Desk

www.refdesk.com

10C- The student is expected to evaluate research projects related to a current issue in food science, technology, and nutrition.

1) CLASS DISCUSSION/INDIVIDUAL ACTIVITY

Have students review the information on evaluating research found in Chapter 18 of the *Food Science and Technology Reference Book*. Distribute copies of Teaching Aid 99, **Components of a Research Article**, to students and have them read the information presented. Display Teaching Aid 99 on the overhead projector, and lead a class discussion on the various components of a research article and how to read the article to determine what was studied, the results, and the conclusions drawn based on the results.

Distribute copies of Teaching Aids 100a-c, **A Research Article**, and Teaching Aid 101, **Evaluating Current Research Projects**, to students. Instruct students to read the article and then respond to the questions on Teaching Aid 101. When all students have finished, have student volunteers share their responses to the questions on the worksheet with the class.

KEY QUESTION

- How does knowledge and understanding of the components of a research article assist individuals in evaluating research projects?



2) GUEST SPEAKER

Invite a county extension agent for Family and Consumer Sciences or Agriculture to speak to the class on current research in food science, food technology, or nutrition and how this research impacts their job. Have students prepare questions for the speaker or suggest topics in advance that they would like the speaker to address.

KEY QUESTIONS

- What research is currently being conducted by the extension service?
- How does this research impact work done by agents in individual counties?
- How are results of this research shared with Texans?
- What background do these researchers need to be qualified for their jobs?

NOTES

TA 99 *Components of a Research Article*

TA 100a-c
A Research Article

TA 101 *Evaluating Current Research Projects*

TAAS
READING

SCIENCE

SCIENCE

NOTES

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 18.

10D- The student is expected to utilize research methods to create projects related to a current issue in food science, technology, and nutrition.

1) CLASS DISCUSSION/INDIVIDUAL ACTIVITY

Have students review the information on research methods found in Chapter 18 of the *Food Science and Technology Reference Book*. Distribute copies of Teaching Aid 102, *The Scientific Method of Investigation*, to students, and have them read it individually. After all students have finished reading, lead a class discussion on the steps and procedures used in the scientific method of investigation.

KEY QUESTIONS

- Why is a statement of the problem or question important?
- What is the purpose of gathering information about the topic?
- What is the purpose of a hypothesis?
- Why should the procedures be outlined in advance?
- What is the importance of accurately recording data that are collected?
- Why are conclusions important?
- What is the importance of a written report of the investigation?

Review with students the steps in the scientific method of investigation and in conducting research and how these steps provide a framework for all types of research projects. Using the steps in the scientific method of investigation or the steps in conducting research as a framework, have students outline the procedures for conducting each of the following sample projects.

- Determine ways to alter family menus for a family member on a low cholesterol, low fat, or diabetic diet. Use nutrient analysis software to determine nutrient content of meals and compare to the Recommended Dietary Allowances for individual family members.
- Research effective methods for solving world hunger problems.
- Investigate the possible consequences of eating disorders on long-term health.

Have student volunteers write their research methods (steps, procedures) on the board for each of the sample projects.

NOTES

TA 102 *The Scientific Method of Investigation*

SCIENCE

NOTES

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 18.

Food Science and Technology

Knowledge and Skills.

(11) World food supply.

The student contrasts basic physical survival with quality of life.

The student is expected to:

- (A) describe the relationship of good health and nutrition to job performance and relationships;
- (B) explain the relationship of the food supply to quality of life;
- (C) explain how the long-term effects of hunger affect a society and world progress;
and
- (D) contrast the nutrition in developed and developing countries.

11A- The student is expected to describe the relationship of good health and nutrition to job performance and relationships.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 14 in the *Food Science and Technology Reference Book* or other references on the relationship of good health and nutrition to job performance and relationships. Have students discuss key points presented in the chapter.

KEY QUESTIONS

- What does current research say about the link between nutrition, good health and job performance?
- How does poor nutritional health affect job performance and relationships with others?
- What are the long-term implications of good nutrition and other practices that promote health on employment, retirement, and quality of life?

2) DEBATE/LISTENING TEAMS



Divide the class into debate teams. (A typical debate team would have three to five members; however, additional students may be added to the debate team to research and organize information while others prepare for the actual debate.) Have the teams debate the following issue:

- Nutrition and good health affect job performance and relationships.

Distribute copies of Teaching Aid 84, *Guidelines for a Classroom Debate*, to students. Review the procedures with the class being sure that students understand the difference between a debate, a discussion, and a disagreement. Students will need to research information to present their point of view.

Divide the remainder of the students (the audience) into listening teams. Assign each team a different aspect of the debate to listen for and instruct them to make notes on their topic during the debate, citing points made by both sides. At the conclusion of the debate, ask student volunteers from each listening team to summarize important points presented by both sides.

3) GUEST SPEAKER



Invite a manager or business owner to discuss with the class how they see job performance affected by good health and nutrition with their employees and other individuals with whom they work.

NOTES

TAAS
READING

TA 84 *Guidelines for a
Classroom
Debate*

TAAS
READING



NOTES



FCCLA ACTIVITIES

- Power of One: A Better You; Family Ties
- Student Body

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 14.

WEB SITES

The Electronic Library

www.elibrary.com

www.newstrawler.com

Internet Public Library

www.ipl.org

The Library of Congress

www.locweb.loc.gov

Look Smart

www.looksmart.com

The Mining Company

<http://miningco.com>

Research It!

www.itools.com/research-it/research-it.html

Science Surf

www.weber.u.washington.edu/~wcalvin/scisurf.html

Virtual Reference Desk

www.refdesk.com

11B- The student is expected to explain the relationship of the food supply to quality of life.

1) VIDEOTAPE/GROUP ACTIVITY



In many parts of the world and also in the United States, people do not have enough food. For them, mere survival is the most important reason to eat. Show students a vignette from television or a video that discusses the problems of hunger in our world. If videotapes are unavailable, discuss with students advertisements they have seen on television, in newspapers, or magazines which increased their awareness of world hunger (e.g., UNICEF, Save the Children, Feed the Children).

Divide students into small groups. Instruct students to discuss responses to the questions on Teaching Aid 103, *Hunger in Our World*, and be prepared to share their responses with the class.

KEY QUESTION

- What is the relationship of the food supply to quality of life?

2) CLASS DISCUSSION/VISUAL DISPLAY



Distribute copies of Teaching Aids 104a-b, *Factors Affecting the Food Supply*, to students for them to read individually. Lead a class discussion about how each of these factors affect the food supply and the problems associated with hunger.

Provide students with art materials, such as large sheets of drawing paper, markers, crayons, pencils, water colors, etc. Instruct students to represent one of the factors affecting the food supply in a drawing. Encourage students to be creative in their artistic representations. Have student volunteers explain their illustrations to the class. Have students use their illustrations to create a display for the classroom or design a showcase using the illustrations as a theme.

3) CASE STUDIES/GROUP ACTIVITY



Divide students into small groups. Using Teaching Aid 105, *Living to Survive*, assign each group a case study that describes the relationship of the food supply to quality of life. Have students determine the nutrition problems depicted in the case studies and discuss their effects on quality of life. Have students share their responses with the class.

4) FCCLA PROJECT

Have chapter members organize a community food drive to assist families in need. Students could solicit the support of other student

NOTES

TA 103 *Hunger in Our World*

**SOCIAL
STUDIES**

**TA 104a-b
*Factors Affecting
the Food Supply***

**TAAS
READING**

**SOCIAL
STUDIES**

TA 105 *Living to Survive*

**SOCIAL
STUDIES**



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organizations or the entire student body. In lieu of a single food drive, chapter members could adopt community hunger as a project and commit to an ongoing food drive to address hunger problems in the community.



FCCLA ACTIVITIES

- STAR Events: Chapter Service Project; Illustrated Talk
- Chapter Project: Chapter members donate food items for a local food bank and/or assist the food bank in packaging, arranging, cleaning or whatever tasks are needed.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 14.

WEB SITES

Bread for the World
www.bread.org/

Feed the Children
www.feedthechildren.org/

The Hunger Project
www.thp.org/

National Center for Education in Maternal and Child Health
www.ncemch.georgetown.edu/

Save the Children
www.savethechildren.org/

UNICEF
www.unicef.org/

11C- The student is expected to explain how the long-term effects of hunger affect a society and world progress.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 15 in the *Food Science and Technology Reference Book* or other references on the effects of hunger on society and world progress. Have students discuss key points presented in the chapter.

KEY QUESTIONS

- What factors contribute to hunger and malnutrition in our world?
- How are world trade activities related to world hunger?
- If there is currently enough food produced to feed all the people of the world, why are there still so many hungry people?
- What are some of the advances that have helped solve hunger problems in parts of the world?

2) CRITICAL THINKING/GROUP ACTIVITY



Arrange the classroom tables, chairs, or desks to resemble a conference room for a meeting of a board of directors. Have students take their places around the "conference table" and tell them they are members of the Board of Directors of Feed Our World, Inc. (a fictitious organization). Feed Our World, Inc. is a nonprofit organization challenged with finding solutions to world hunger and thus counteracting the long-term effects of hunger on society. Have students elect a chairperson to head the Board of Directors. Tell students that during their meeting today, the board is to address the following issues:

- How are health, education, and distribution of income related to the long-term effects of hunger?
- What other issues are involved with hunger, short-term and long-term?
- What are some possible solutions to the problems of world hunger?
- What steps can Feed Our World, Inc. take to begin solving this hunger problem?

At the close of the class period, ask student volunteers to summarize what thoughts about world hunger they had that were prompted by the discussion.

KEY QUESTION

- How can individuals and community organizations work toward solving world hunger problems?

NOTES

**TAAAS
READING**

**SOCIAL
STUDIES**

**SOCIAL
STUDIES**

NOTES



FCCLA ACTIVITIES

- Power of One: Take the Lead
- STAR Events: Focus on Children; Illustrated Talk
- Chapter Project: Chapter members investigate how their local officials are addressing hunger in the community. Have chapter members develop plans for providing assistance toward solving hunger problems in the local community.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

WEB SITES

Utah State Office of Education (utahlink)

www.uen.org/utahlink/

(Select Teacher Resources; Curriculum; Family and Consumer Sciences)

11D- The student is expected to contrast the nutrition in developed and developing countries.

1) CRITICAL THINKING/WRITTEN EXERCISE

Have students read Chapter 15 in the *Food Science and Technology Reference Book* or other references on the nutrition in developed and developing countries. Have students discuss key points presented in the chapter.

KEY QUESTIONS

- What is a developed country?
- What is a developing country?
- What characteristics differentiate developed and developing countries?
- What is a dietary mainstay?
- What are the dietary mainstays in developed countries?
- What are the dietary mainstays in developing countries?

Distribute copies of Teaching Aid 106, *You Are an Ambassador to the United Nations*, to students. Have them work individually to respond to each of the questions on the worksheet. Have students share their responses and participate in a class discussion on the issues related to this problem.

2) RESEARCH/PROJECT/ORAL PRESENTATION



Following the activities detailed in Strategy 1 above, have each student select a developed and a developing country and research information on the nutritional health and food patterns of the people in each country. Students will need access to library resources and/or the Internet for this activity.

Distribute copies of Teaching Aid 107, *Nutrition in Developed and Developing Countries*, to students. Instruct students to use available reference materials to research information on their two countries. Remind students to include reference information on the back of the worksheet. Provide paper, map pencils, and other art supplies for the student maps.

In a round table format, have students present the information they gathered on their countries and compare and contrast the nutritional health of the people of those countries. Post the students' charts and maps around the classroom.

NOTES

TA 106 *You Are an Ambassador to the United Nations*

TAAS
READING

SOCIAL
STUDIES

TA 107 *Nutrition in Developed and Developing Countries*

TAAS
READING

SOCIAL
STUDIES



NOTES

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

WEB SITES

Food and Agricultural Organization of the United Nations (FAO)
www.fao.org/

International Food Information Council (IFIC)
<http://ificinfo.health.org>

Internet Public Library
www.ipl.org

Virtual Reference Desk
www.refdesk.com

World Health Organization
www.who.org/

Food Science and Technology

Knowledge and Skills.

(12) World food supply.

The student analyzes food supply, distribution, and nutrition from a global perspective.

The student is expected to:

- (A) analyze factors that influence the food chain, pricing, and choices;
- (B) determine the demands placed on food science and technology by American societal patterns;
- (C) describe technological, ecological, and sociological factors affecting world food supply;
- (D) explain the roles that world food trade policies and governments play in world progress related to nutrition;
- (E) describe international organizations dealing with world food supply and contributing to improved nutrition;
- (F) analyze the problems of world hunger; and
- (G) predict possible solutions to the problems of world hunger.

12A- The student is expected to analyze factors that influence the food chain, pricing, and choices.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students review information found in Chapter 15 in the *Food Science and Technology Reference Book* or other references on the factors that influence the food chain, pricing, and choices. Display Teaching Aid 108, **The Food Chain**, on the overhead projector. Explain to students what is meant by the food chain and how everything we eat is connected to the food chain. Display Teaching Aid 109, **The Food Web**. Help students understand how the food web shows the complex linkages of plants and animals within the food chain. Lead students in a discussion of the key points presented in the chapters.

KEY QUESTIONS

- What is the food chain?
- What is the food web?
- What is the primary function of the food chain?
- How fragile is the food chain?



2) VIDEOTAPE/GUEST SPEAKER

Have students view a videotape on the food chain. Invite the agricultural science teacher to speak to the class on the importance of the food chain in all parts of the world and on the factors that influence the food chain.

KEY QUESTIONS

- Why is the food chain important?
- If parts of the food chain are interrupted in the world, how would this impact world food production, food availability, nutrition, and well-being of the population?
- What can governments do to help protect the food chain?
- How do human beings hinder the food chain?



3) TEAMWORK

Divide students into teams of three. Distribute copies of Teaching Aids 110a-c, **Analyzing Factors that Influence the Food Chain, Food Pricing, and Food Choices**, to students. Instruct students that they are to work together to complete the diagram however they choose. For example, a team may choose to divide the diagram into three parts and each team member take a part to research and complete, or a team may decide to work on the entire diagram together as a group. After the allotted time for research and completion of the diagram has elapsed, have each team select a spokesperson to share their findings. As a

NOTES

TA 108 *The Food Chain*

TA 109 *The Food Web*

TAAS
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TA 110a-c

**Analyzing
Factors that
Influence the
Food Chain, Food
Pricing, and Food
Choices**

TAAS
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class, compare and contrast the similarities and differences among the teams' findings.

Examples of student responses for Teaching Aids 110a-c include:

-Factors influencing the food chain:

- agricultural
- economic
- political
- societal
- technological

-Factors influencing food pricing:

- agricultural expenses
- crop size
- weather conditions
- processing costs
- transportation
- marketing
- advertising
- storage
- government regulations
- loss due to spoilage, shoplifting, etc.

-Factors influencing food choices:

- culture
- education
- life-style
- demand and availability of highly processed foods
- personal preferences

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

12B- The student is expected to determine the demands placed on food science and technology by American societal patterns.

1) BRAINSTORMING/GROUP ACTIVITY



Have students brainstorm and list demands placed on food science and technology by American societal patterns. Examples might include:

- food safety; purity
- user-friendly and environmentally friendly food packaging
- high quality foods
- increased nutritive value in foods
- low-fat food products
- reduced calorie food products
- increased variety of convenience food items

Divide the class into small groups. Assign each group a specific topic from the brainstorming list. Have each group research information on their topic using library and classroom resources and the Internet to become "expert authorities" on their topic. Have students refer to Chapter 14 in the *Food Science and Technology Reference Book* for additional information. Regroup the students so that one "expert authority" for each topic is in each group. Have each group member share their "expert knowledge" or "teach" each other. Bring the class together to debate the issues.

KEY QUESTION

- How has American food technology changed in the past 50 years to accommodate the American consumer?

2) EDUCATIONAL TOUR

Arrange for students to take an educational tour (investigative search) to a local supermarket to examine the new products that have resulted from demands placed on food science and technology by American societal patterns. Changes in food products students might look for include:

- single-serving packaging
- pre-packaged green salads, cole slaw, and fresh vegetables
- convenience food items developed especially for children and others with special needs
- foods with longer shelf life
- greater variety of food items
- unit pricing
- detailed food labeling
- recycled packaging materials
- increased variety of low-fat, low-sodium, or fat-free foods
- tofu
- sugar-free foods

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TAAS
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Discuss with students how consumers and their patterns of living have placed tremendous demands on those businesses and industries supplying food products. For example, consumers are continuously demanding more convenience foods that are high quality, nutritious, have user-friendly and environmentally safe packaging and are time efficient in preparation. Point out to students the vast changes that have taken place just in the past two decades. If possible, have the store manager share with the students the changes in the grocery business during his or her professional career.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 14.

12C- The student is expected to describe technological, ecological, and sociological factors affecting world food supply.

1) VISUAL DISPLAY/GROUP ACTIVITY



Have students read and review the information in Chapter 14 of the *Food Science and Technology Reference Book* on factors affecting the world food supply. Lead a class discussion regarding the factors related to the supply of food to meet the nutritional needs of the world's population. Use the web diagram technique to illustrate the factors and the issues and/or problems associated with each factor. Have a student volunteer draw the web diagram on a large sheet of butcher paper displayed so that all students can see it. Use Teaching Aid 111, ***The World Food Supply***, as a teacher resource; it gives suggested ideas for you to help students with their brainstorming.

Divide the students into six small groups, assigning each group a different category to consider. Instruct students to brainstorm and identify at least three factors for their category. Students may use social studies textbooks, encyclopedias, library resources, or the Internet to gather information. Most of these can be identified by students without the use of resources after they spend some time brainstorming and dialoguing within their groups.

When the group has identified as many factors for their category as they can think of, have a group representative add their factors to the web diagram, drawing additional circles or boxes as needed.

Discuss with students the cause and effect relationship of the factors and issues involved using the following key questions.

KEY QUESTIONS

- In what ways are people responsible for the current status of the world food supply?
- How can developed countries assist developing countries with solutions to food supply problems?
- How are the quantity and quality of the food supply affected by climate and soil conditions?
- Are the governments of countries around the world part of the food supply problems, or are they part of the solution? Why?
- Which of the factors are currently addressed through actions of private or public organizations?
- Which world food supply problems will require the cooperation of many nations?
- Which of the factors involve the United States?

NOTES

TA 111 *The World Food Supply*

**SOCIAL
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NOTES**2) BRAINSTORMING/INDIVIDUAL ACTIVITY**

Lead a class brainstorming session having students identify topics related to technological, ecological, and sociological factors affecting world food supply. Review students on the factors identified in Strategy 1 above.

Through newspaper, magazine, journal, and Internet searches, have students collect articles on these issues or others as discussed in class. Have each student read and give an oral summary of one article to the class in an informal, roundtable format. Have students add these articles to the classroom file described in Strategy 1, TEKS 7A.

KEY QUESTION

- How are we directly or indirectly affected by factors affecting the world food supply?

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 14.

12D- The student is expected to explain the roles that world food trade policies and governments play in world progress related to nutrition.

1) CLASS DISCUSSION/WRITTEN EXERCISE

Read aloud to students the narrative on Teaching Aid 112, *Living the Life of the One Billion Poorest in Our World*. Display the web diagram students produced in Strategy 1 of TEKS 12C. Review with students the factors affecting the world food supply.

KEY QUESTIONS

- Which of the factors are caused by people, including governments?
- Which of the factors are currently being addressed by public or private organizations?
- Which of the factors could be solved by some nations on their own?
- Which factors need the assistance of developed nations?
- What role do world trade policies play in solving the world food supply problems?
- What role do governments play in world progress toward eradicating hunger and malnutrition in our world?

Following the reading and class discussion, have students write a reaction paper based on their personal opinions related to the role of world trade policies and governments in eradicating hunger and malnutrition. Ask student volunteers to read their reaction papers aloud to the class.

KEY QUESTION

- How have world food trade policies affected your community?

2) GAME



Using Teaching Aid 113, *Game Board*, as a pattern, make enough game boards and card sets for students to play in groups of five. A pattern for the card sets are shown on Teaching Aid 114, *Game Card Sets*. Note that the answer to the question is on the card with the question. Therefore, students will need to take turns reading the questions to each other. If a student misses the question, he or she loses his or her turn and play proceeds to the next student. Use buttons, colored dots, or small toys as game pieces; each game board needs one dice. The game works similar to Trivial Pursuit™ or other question and answer type games. The players roll the dice and move forward that number of spaces and then follow the instructions on the space where they land. The winner of the game is the first one to reach the finish line.

A review of information related to the game questions would be beneficial for students and also make the game more fair.

NOTES

TA 112 *Living the Life of the One Billion Poorest in Our World*

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WRITING**

**SOCIAL
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TA 113 *Game Board*

TA 114 *Game Card Sets*

**SOCIAL
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NOTES



FCCLA ACTIVITIES

- Power of One: Take the Lead
- STAR Event: Illustrated Talk

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

WEB SITE

World Trade Organization
www.wto.org/

12E- The student is expected to describe international organizations dealing with world food supply and contributing to improved nutrition.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students review the sections on international organizations dealing with the world food supply and world food trade policies in Chapter 15 of the *Food Science and Technology Reference Book*, or have students read information on this topic found in library resources or on the Internet. Display Teaching Aid 115, **Organizational Goals Toward Solving World Hunger Problems**, on the overhead projector. Review the goals with students and have them identify additional goals they would add to the list, such as, "to raise educational levels of people in developing countries." Have a student volunteer add the additional goals to the list. If time allows, have a student write the goals on butcher paper or poster board and display in the classroom.

Lead a class discussion on the international organizations that work toward improved nutrition and the world food supply such as:

- The Food and Agriculture Organization (FAO)
- The World Health Organization (WHO)

Use Teaching Aid 116, **Preamble to the Constitution of the Food and Agriculture Organization**, and Teaching Aid 117, **Program Goals of the World Health Organization (WHO)**, to assist with the discussion.

KEY QUESTIONS

- What are the purposes of the FAO and WHO?
- What actions have been taken by the United States that impact world food trade?
- Do current world food trade policies need to be changed? How?

2) TEAMWORK/RESEARCH/ORAL PRESENTATION



Divide students into teams. Assign each team one organization to research. Have students use library resources and the Internet to locate and read information on the Food and Agriculture Organization, the World Health Organization, or United Nation's Children's Fund.

Have students prepare an oral report for the class on their organization, using appropriate media, such as computer word processing, computer graphics, projection panel, Power Point, videotape, overhead projector, or other audiovisual techniques.

NOTES

TA 115 Organizational Goals Toward Solving World Hunger Problems

TA 116 Preamble to the Constitution of the Food and Agriculture Organization

TA 117 Program Goals of the World Health Organization (WHO)

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RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

WEB SITES

Food and Agriculture Organization (FAO)
www.fao.org/

Internet Public Library
www.ipl.org

UNICEF
www.unicef.org/

Virtual Reference Desk
www.refdesk.com

World Health Organization
www.who.org/

12F- The student is expected to analyze the problems of world hunger.

1) **VIDEOTAPE/PROBLEM SOLVING/GROUP ACTIVITY**



Introduce the lesson by showing a video clip from the movie, *Apollo 13*, where the astronauts first encounter the problem of the explosion in the rocket's oxygen tank, and Tom Hanks radios NASA and says, "Houston, we have a problem." Following the video clip, write on the board, "Americans, we have a problem."

Tell students that they are going to take a look at the problems of hunger in our world. Display Teaching Aid 118, **Terms Associated with Hunger**, on the overhead projector. Review the terms with students. Display Teaching Aid 119, **Problem Solving**, on the overhead projector. Review with students the steps in the problem-solving process and walk them through the steps using the following examples or another example of your choice:

- Problem: What to do after high school?

Discuss with students about different kinds of problems and how the problem of world hunger seems so enormous that many citizens try to ignore it as they feel they do not have any control over it or impact on it. However, that is not the case. Every American can begin by looking at the problems of hunger in their own communities and begin first by trying to solve those problems locally.

Divide the students into small groups of four or five students. Distribute copies of Teaching Aids 120a-b, **Solving Problems Through Effective Reasoning**, to students. Instruct students to select a group leader and discuss the problems associated with world hunger in their group. Encourage students to review the information on world hunger found in Chapter 15 of the *Food Science and Technology Reference Book*. After their discussion, tell them to use the REASON model to arrive at some solutions for the world hunger problem. Have each group share their results with the class.

2) **GUEST SPEAKER**



Invite a guest speaker who has participated in the Peace Corps, served as a missionary to a developing country, visited a developing country, participated with organizations dedicated to solving world hunger problems, a health professional, or anyone else who has knowledge of hunger. In advance of the speaker, lead students to develop appropriate questions and/or topics for the speaker. Recognize the sensitivity of this topic and help students to understand that solving world hunger problems rests ultimately with all citizens of developed nations.

NOTES

TA 118 **Terms Associated with Hunger**

TA 119 **Problem Solving**

TA 120a-b
Solving Problems Through Effective Reasoning

SOCIAL STUDIES

SOCIAL STUDIES

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3) CRITICAL THINKING

Divide students into pairs. Write the following paragraph on the board or a transparency:

Explain how the long-term effects of hunger can affect a society. Relate issues, such as health, education, and distribution of income, to the long-term effects of hunger. What other issues are involved? What are some possible solutions to the problems of world hunger?

Have students discuss these issues with their partner and then in a round-table discussion, have students share their responses with the class.

4) CLASS DISCUSSION/WRITTEN EXERCISE

Discuss ways in which the United States is involved in the humanitarian efforts toward eliminating world hunger. Have each student write a one-page essay responding to the following prompt:

What are the implications of ignoring the problems of world hunger?

Have student volunteers share their essays with the class. Select several to submit to the school newspaper for publication.

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

12G- The student is expected to predict possible solutions to the problems of world hunger.

1) PROJECT/TEAMWORK



This is a multi-step team project. Divide students into teams of three or four students.

- 1) Assign each team one or more of the following developments in food science to research using library resources or the Internet:

- agribusiness
- genetic engineering
- recombinant DNA
- cell fusion
- hybrids
- polyculture
- aquaculture
- hydroponics

Have each team report their findings to the class.

- 2) Instruct each team to research information on a developing country regarding:

- food production
- hunger/malnutrition
- economics
- geographical area/conditions of the land
- political environment

Examples of developing countries include Kenya, Sudan, Ethiopia, North Korea, Vietnam, Nepal, India, Bangladesh, and El Salvador.

- 3) Based on what the team learns about their developing country, information on developments in food science, and what they have learned in this course, have team members address the following in regard to their developing country.

- Determine a way to best help fight the hunger and malnutrition problems in your country.
- Outline the procedure you would follow.
- With which political leaders would you have to communicate?
- What plans would you give these political leaders?
- How would you justify your plans? (e.g., is the geographical environment suitable for aquaculture?)
- What problems might you encounter?
- Could this project be completed with the help of local citizens? How would you do this?
- How could you evaluate the success of this project?

- 4) Instruct students to prepare a team oral presentation for the class. Teams should include audiovisuals/media tools as appropriate to facilitate their presentation. Examples include maps, computer-generated handouts, transparencies, posters, Power

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TA 78 Activity Assessment

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Point, videotapes, etc. Encourage students to visit with social studies teachers for suggested references or resources they could use.

- 5) Have students use Teaching Aid 78, **Activity Assessment**, as an evaluation of the project experience.

2) FCCLA/PROJECT

Have FCCLA chapter members plan and organize a "World Hunger Day" to bring the community's attention to the problems of world hunger. Many organizations associated with fighting world hunger have literature and information to help students in their planning. Involve chapter members in securing school and community publicity in support of their project.

FCCLA ACTIVITIES

- Power of One: Take the Lead; Speak Out for FCCLA
- STAR Events: Applied Technology; Chapter Service Project; Focus on Children; Illustrated Talk

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 15.

WEB SITES

Food and Agriculture Organization (FAO)
www.fao.org/

Internet Public Library
www.ipl.org

UNICEF
www.unicef.org/

Virtual Reference Desk
www.refdesk.com

World Health Organization
www.who.org/

Food Science and Technology

Knowledge and Skills.

(13) Career preparation.

The student determines opportunities and preparation requirements for careers in nutrition, food science, and food technology.

The student is expected to:

- (A) determine employment and entrepreneurial opportunities and preparation requirements for careers in nutrition, food science, and technology;
- (B) compare personal characteristics to those needed for careers in nutrition, food science, and technology; and
- (C) propose short-term and long-term career goals.

13A- The student is expected to determine employment and entrepreneurial opportunities and preparation requirements for careers in nutrition, food science, and technology.

1) VIDEOTAPE/CLASS DISCUSSION/GROUP ACTIVITY



Have students view the videos, *In Good Taste . . . Careers in Food Science*, produced by the Society for Food Science and Technology, and *Careers in Nutrition*, available from The Curriculum Center for Family and Consumer Sciences, or other videos that address careers in food science, food technology, or nutrition.

After students have viewed the videos, lead a class discussion on careers options in the food and nutrition industries. Divide the students into small groups. Display Teaching Aid 121, ***Career Concentration: Nutrition and Wellness/Food Science and Technology Examples of Career Opportunities***, on the overhead projector, and provide each group with the "want ad" section from a large urban newspaper. Distribute Teaching Aid 122, ***Careers in Food Science and Technology***, to students. Instruct students to work together to complete questions 1-6 on the worksheet.

Have students read Chapter 1 in the *Food Science and Technology Reference Book* and then use the *Dictionary of Occupational Titles*, the *Occupational Outlook Handbook*, and other career resources to complete questions 7-10. Have each group share their career information with the class.

2) GUEST SPEAKER



Invite the school counselor or a community college career counselor to speak to the class on preparation requirements for careers in food science, food technology, and nutrition. Have the speaker bring copies of community college and university catalogs for students to examine. In advance of the speaker's presentation, discuss with students what type of career preparation information they would like to be discussed and encourage students to ask questions during the presentation.

3) BRAINSTORMING/CLASS DISCUSSION



Have students brainstorm and list as many entrepreneurship opportunities in the food industries that they can think of. Examples include restaurant owner, caterer, independent consultant: food technology, owner of specialty food business, dietitian, nutrition consultant, etc. Lead a class discussion on these opportunities and factors to be considered before becoming an entrepreneur.

KEY QUESTIONS

- What societal patterns are influencing entrepreneurship in food industry careers?
- What factors should be considered when analyzing entrepreneurship opportunities?

NOTES

TA 121 Career

**Concentration:
Nutrition and
Wellness/Food
Science and
Technology
Examples of
Career
Opportunities**

TA 122 Careers in Food Science and Technology



NOTES



FCCLA ACTIVITIES

- FCCLA Career Connection: PROGRAM Career Steps
- Power of One: Working on Working
- STAR Event: Skills for Life

RESOURCES

BOOKS

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 1.

VIDEOTAPES

Careers in Nutrition, available from The Curriculum Center for Family and Consumer Sciences.

In Good Taste . . . Careers in Food Science, produced by the Society for Food Science and Technology.

WEB SITES

Dictionary of Occupational Titles

www.wave.net/upg/immigration/dot_index.html

Institute of Food Science and Technology

www.ifst.org/

Institute of Food Technologists

www.ift.org/

Internet Public Library

www.ipl.org

Occupational Outlook Handbook

<http://stats.bls.gov/ocohome.htm>

Universities on the Net

www.universities.com

www.clas.ufl.edu/CLAS/american-universities.html

Virtual Reference Desk

www.refdesk.com

13B- The student is expected to compare personal characteristics to those needed for careers in nutrition, food science, and technology.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students read Chapter 2 in the *Food Science and Technology Reference Book* or other references on characteristics needed for careers in nutrition, food science, and technology. Have students discuss key points presented in the chapter.

KEY QUESTIONS

- Why is it important to assess your personal interests, characteristics, and skills when identifying potential career options?
- How can you determine your personal interests and characteristics?
- What characteristics are needed for careers in nutrition, food science, and food technology?
- Why are these characteristics important?
- How can individuals acquire skills and characteristics needed for these careers?

2) INDIVIDUAL ACTIVITY

Have students design their own Web page. The purpose of the Web page is to highlight the student's personal interests, characteristics, and skills and compare/relate those to characteristics needed for careers in nutrition, food science, and food technology. Have students create the Web page about themselves but use a fictitious name. Encourage students to use creativity and to choose from a variety of media (crayons, markers, computer-generated designs, collage, etc.) in preparing their Web page. Components of the Web page include:

- Personal characteristics (e.g., outgoing, assertive, shy)
- Skills
- Personal interests (hobbies, etc.)

Have students turn in their Web pages. Display the Web pages around the classroom and tape a blank sheet of notebook paper to the bottom of the Web page. Using Teaching Aid 121, ***Career Concentration: Nutrition and Wellness/Food Science and Technology Examples of Career Opportunities***, have students circulate around the room and match careers with the skills and characteristics described on the individual Web pages. Students are to write the suggested career matches on the sheet of paper taped to the bottom of the Web page. After all the Web pages have been examined, allow students an opportunity to circulate and find their Web page and career matches.

KEY QUESTION

- How are personal characteristics, skills, and interests related to career options and choices?

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TAAS
READING

**TA 121 Career
Concentration:
Nutrition and
Wellness/Food
Science and
Technology
Examples of
Career
Opportunities**



NOTES



FCCLA ACTIVITIES

- FCCLA Career Connection: SIGN ON to the Career Connection
- Power of One: Working on Working

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 2.

WEB SITES

Library of the Workplace
www.cord.org/workplacelibrary

Monster Board
www.monster.com

Occupational Outlook Handbook
stats.bls.gov/ocohome.htm

Online Career Center
www.occ.com/occ/

13C- The student is expected to propose short-term and long-term career goals.

1) CLASS DISCUSSION/INTERVIEW

Discuss with students the importance of goal setting. Display Teaching Aid 123, **Goals**, on the overhead projector and discuss with students the differences between short-term and long-term goals. Point out to students that the achievement of long-term goals is directly related to the setting and accomplishment of short-term goals. Have students review Chapter 1 in the *Food Science and Technology Reference Book* for information on goals. Refer to *Skills for Life*, Module 8B, "Goal Setting and Decision Making" for background information.

KEY QUESTIONS

- Why is goal-setting an important part of reaching career goals?
- What are examples of long-term goals in the food science and food technology career area?
- What are some examples of short-term goals that would be important to the accomplishment of these long-term career goals?
- How is the failure to set career goals related to an individual's career success?
- Why is it important to write out your goals?
- What should a well-written goal include? (time frame, standard for measuring success, and expected outcome)

Instruct students to interview a teacher, counselor, or administrator to determine how goals, both short-term and long-term, impacted their career success. Have students summarize key points of their interviews in writing.

2) INTERNET ACTIVITIES/GROUP ACTIVITY



Have students work in small groups and visit several career-related Internet sites. (See RESOURCES on the back of this page.) Instruct students to search for information on two different careers in food science, food technology, or nutrition careers. For each of the careers, have students propose two long-term goals and as many short-term goals as needed to reach each long-term goal. Have students create a visual aid that reflects their work, such as posters, transparencies, computer-generated handouts, etc.

NOTES

TA 123 Goals

**TAAS
WRITING**



**TAAS
READING**



NOTES



FCCLA ACTIVITIES

- FCCLA Career Connection: SIGN ON to the Career Connection
- Power of One: Working on Working
- STAR Event: Skills for Life

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 1.

Home Economics Curriculum Center, 1997. *Skills for Life*, Module 8B, "Goal Setting and Decision Making."

WEB SITES

America's Career InfoNet
www.acinet.org/

The Monster Board: Jobs On Line
www.monsterboard.com/

Occupational Outlook Handbook
<http://stats.bls.gov/ocohome.htm>

The Riley Guide
www.rileyguide.com

What Color Is Your Parachute?
www.washingtonpost.com/parachute

Food Science and Technology

Knowledge and Skills.

(14) Career preparation.

The student exhibits employability skills.

The student is expected to:

- (A) describe management practices facilitating individuals assuming multiple family, community, and wage-earner roles;
- (B) practice positive human-relations skills;
- (C) demonstrate effective verbal, nonverbal, written, and electronic communication skills;
- (D) demonstrate effective methods to secure, maintain, and terminate employment;
- (E) identify ethical practices in the workplace; and
- (F) practice problem solving, using leadership and teamwork skills.

14A- The student is expected to describe management practices facilitating individuals assuming multiple family, community, and wage-earner roles.

1) INDIVIDUAL ACTIVITY/CLASS DISCUSSION

Have students review the information in Chapter 2 in the *Food Science and Technology Reference Book* on "Management Practices and Multiple Roles." Lead a class discussion on various management practices that help individuals and families manage multiple roles.

KEY QUESTIONS

- What is meant by "multiple roles"?
- What types of management skills are needed when individuals are functioning in many roles?
- How does a career affect an individual's personal and family life?
- What effect do occupational demands have on individual and family life?

2) WRITTEN EXERCISE/CLASS DISCUSSION

Distribute Teaching Aid 124, *How Many Roles Do You Juggle?*, to students. Have each student consider the challenge of managing multiple roles by thinking about their present day to day lives and completing the worksheet.

Discuss with students roles they identified and the challenge individuals face when trying to juggle multiple roles.

KEY QUESTIONS

- What roles do teenagers have that are not listed?
- What do individuals mean when they say, "I'm trying to do it all"?
- Why is it not possible to "do it all"?
- What are the results when someone managing multiple roles tries to "do it all"?
- How are families, with whom you are familiar, handling the challenge of managing multiple roles?
- What can you do to help your family more effectively manage the multiple roles associated with family, work, and personal lives?
- What is the importance of sharing family roles and responsibilities in our society today? Why?
- What is meant by family interdependence?

3) GROUP ACTIVITY/BROCHURES

Discuss with students how there are four important components of successful management:

- Planning



NOTES

TAAS
READING

**TA 124 How Many Roles
Do You Juggle?**

**TA 125 Keys to
Management of
Multiple Roles**

NOTES

TAAS
WRITING



- Organizing
- Implementing
- Evaluating

Display Teaching Aid 125, **Keys to Management of Multiple Roles**. Discuss with students how the components of management are interdependent just as interdependence among family members helps in the management of multiple roles.

Divide students into small groups. Have each group identify and describe management practices that help individuals manage multiple roles. Instruct each group to use computer word processing or desktop publishing software to create a brochure on management practices that facilitate individuals assume multiple family, career, and community roles. Assist students with editing their brochures, select one or more brochures appropriate for reproduction, and have students distribute them within the community.

FCCLA ACTIVITIES

- Community Service Award
- Families First: Balancing Family and Career
- FCCLA Career Connection: INTEGRATE Work and Life
- STAR Events: Illustrated Talk; Skills for Life

RESOURCES

BOOKS

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 2.

Felstehausen, G., 1999. "Managing Multiple Roles." *Essentials for Home Economics Education: The Cornerstone*.

Home Economics Curriculum Center, 1997. *Skills for Life*, Module 8A, "Managing Multiple Roles."

14B- The student is expected to practice positive human-relations skills.

1) SYMPOSIUM

Display Teaching Aid 126, *Positive Human Relations Skills*, on the overhead projector. Discuss with students the definition of each term. Divide students into six groups, assigning each group a different human relations skill. Tell students that you are going to have a class "symposium" on human relations skills and their importance in family, career, and community roles. Have students use classroom and library resources and the Internet to gather information for their group's symposium presentation. Instruct class members to compose questions to ask each panel.

At the conclusion of the symposium, have each student write a reaction paper/summary (1 1/2 to 2 pages) of the information learned through the symposium. Instruct students to include the importance of human relations skills in adolescent and adult roles.

The following class period, lead a class discussion on how well the group members practiced human relations skills during the preparation and presentation of the symposium.

KEY QUESTIONS

- What human relations skills need improvement?
- Why are human relations skills an important component of success in managing multiple family, career, and community roles?

2) PROJECT/FCCLA

Have students plan, organize, and implement a family and consumer sciences career day. Instruct students to use the FCCLA planning process as a tool in their planning. Students will need to work with the career or academic counselor in planning this as a school-wide event. Some important questions to consider in planning a family and consumer sciences career day include:

- What type of information on family and consumer sciences careers do we want to provide?
- What degrees or certificates are available in preparation for these careers?
- What colleges, universities, and institutes offer these degrees and certificates?
- What is the demand for careers in these areas?
- Where are the jobs located?
- What are the career advancement opportunities?
- What career education materials will be helpful to career day participants?

NOTES

TA 126 Positive Human Relations Skills

TAAS
READING

TAAS
WRITING



TAAS
READING



NOTES

- Will we have guest speakers? If so, who?
- Who will be the FCCLA contact person for guest speakers?
- What publicity will we need?
- When will the career day occur?
- Where will the career day be held?
- Will we serve refreshments? If so, what will we serve? Who will provide the refreshments?
- What assessment tool will we use to evaluate the success of the career day?

Discuss with students the following key questions.

KEY QUESTIONS

- How important were human relations skills to the planning, organizing, and implementation of the career day?
- Based on your evaluation of the career day, what changes would you make for next year?



FCCLA ACTIVITIES

- FCCLA Career Connection: PLUG IN to Careers; ACCESS SKILLS for Career Success
- Power of One: A Better You
- STAR Events: Interpersonal Communications; Skills for Life

RESOURCES

BOOKS

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 2.

Family, Career, and Community Leaders of America, 1999. *Career Connection*.

14C- The student is expected to demonstrate effective verbal, nonverbal, written, and electronic communication skills.

1) TEAMWORK/PROJECT/ORAL PRESENTATION



Divide students into teams. Instruct each team to write, produce, and present to the class a multimedia presentation about a topic studied in the Food Science and Technology course. Examples of topics include: food safety and sanitation; world hunger and malnutrition; a food science demonstration or experiment; food additives; and, advancements in food science and food technology. Suggestions for presentations include videotapes, Power Point, illustrated talk, puppet show, demonstration, lab experiment, etc. Have students use classroom and library resources and the Internet to gather information for their presentations.

2) BRAINSTORMING/GROUP ACTIVITY



Lead students in brainstorming questions related to topics, such as new trends in food science and technology, food additives, food safety issues, and others that might arise in the area of food science and technology. Divide the class into groups, and instruct each group to use a different form of electronic communication to send questions about these issues to a food science or food technology professional (dietitian, university professor, food technologist, etc.). Forms of electronic communication may include FAX, E-mail, newsgroups, letters written using a word processing program, etc. Have students share their communications and responses they receive with the class. Discuss with students which forms of electronic communication were the most efficient and user-friendly for this purpose.

NOTES

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SCIENCE



NOTES



FCCLA ACTIVITIES

- FCCLA Career Connection: ACCESS SKILLS for Career Success
- Power of One: Working on Working
- STAR Events: Applied Technology; Skills for Life; Job Interview

RESOURCES

14D- The student is expected to demonstrate effective methods to secure, maintain, and terminate employment.

1) INTERNET ACTIVITIES/WRITTEN EXERCISE



Have students work individually or in pairs to navigate through "America's Career Kit" found at the America's Career InfoNet Web site at www.acinet.org/. At this Web site, students can navigate and explore the following links:

- Explore Options for Work and Learning
- Gain Skills to Get a Job or Get a Better Job
- Find Financial Assistance for Education and Training
- Find Job-search Resources and Services to Help You Get a Job
- Find Possible Jobs and Employers

After students have completed the Web site activities, have them use word processing software to write an essay detailing what they learned through this instructional experience.

2) PROJECT

Have students prepare an employment portfolio. Distribute copies of Teaching Aid 127, *The Employment Portfolio*, to students. Discuss the information presented in the teaching aid. Suggested components of the employment portfolio include:

- Resumé
- Goals statement or career objective
- Examples of school work (research projects, essays, etc.) and workplace products (copies of business letters, reports, etc.), if available, that show evidence of the student's knowledge and skills
- A personal reflection on knowledge, skills, and aptitudes considered valuable in the workplace
- Documentation of leadership skills or written description of leadership role performed and skills exhibited
- Employer or teacher evaluations

It is important to provide students with a rubric that details how their portfolio will be evaluated. Background information on portfolio development and a copy of a sample rubric may be found in the publication, "Portfolio Development for Secondary Students" by Lora Ann Neill, Ph.D. This publication is a segment of *Essentials for Home Economics Education: The Cornerstone*, and is available for purchase from The Curriculum Center for Family and Consumer Sciences.

3) GROUP ACTIVITY/INTERVIEW



Divide students into pairs, and have each pair interview two managers/business owners/employers regarding characteristics and skills needed to maintain employment and succeed on the job. A suggested interview question might be, "What skills and characteristics do you consider most valuable in your employees who are the most success-

NOTES

TAAS
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**TA 127 The Employment
Portfolio**

TAAS
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NOTES

TA 128 *Terminating Employment*

TAAS
WRITING



ful at their jobs?" Have students share their responses with the class and prepare a class display or school showcase illustrating skills and characteristics needed for maintaining employment and succeeding at a chosen career.

4) CLASS DISCUSSION/WRITTEN EXERCISE

Distribute copies of Teaching Aid 128, *Terminating Employment*, to students. Lead a class discussion based on the information provided and have students respond to the following key questions.

KEY QUESTIONS

- What are examples of good reasons for leaving a job?
- What are examples of poor judgment in leaving a job?
- Why is it important to terminate a job as positively as possible?
- What impact might techniques used to terminate a job have on future employment opportunities?
- How are job references related to termination policies?
- If you decided to quit a job, what might you tell the employer?

Have students use computer word processing software to write sample letters of resignation to two different employers, one a full-time job and the other a part-time job. Instruct students to follow the tips for writing letters of resignation presented in the teaching aid. Have students work in pairs to critique each other's letters and offer suggestions for improvement. After students have made the recommended revisions, have them turn their letters in for grading.

FCCLA ACTIVITIES

- FCCLA Career Connection: PLUG IN to Careers; LINK UP to Jobs; ACCESS SKILLS for Career Success
- STAR Events: Job Interview; Skills for Life

RESOURCES

BOOKS

Family, Career, and Community Leaders of America, 1999.
Career Connection.

Neill, L.A. "Portfolio Development for Secondary Students," 1998. *Essentials for Home Economics Education: The Cornerstone*.

WEB SITE

America's Career InfoNet
www.acinet.org/

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14E- The student is expected to identify ethical practices in the workplace.

1) **INDIVIDUAL ACTIVITY/CLASS DISCUSSION/TEAMWORK**



Have students read and review information on workplace ethics found in Chapter 2 of the *Food Science and Technology Reference Book*. Distribute index cards to students and ask them to write a definition of the term *ethics*. Collect the cards and read them to the class. While you are reading, ask one students to write on a transparency words or phrases from the cards that can be used to arrive at a class definition of ethics. Teaching Aid 129, *Ethics in the Workplace*, gives a general definition of ethics and can be used as a transparency master or student handout.

Have students use encyclopedias, classroom and library references, and the Internet to gather examples of ethical codes of conduct for various professions. Examples might include the Hippocratic Oath, the Declaration of Geneva, the Code of Ethics for the Profession of Dietetics, or the American Association of Family and Consumer Sciences Statement of Principles of Professional Practice. Lead a class discussion on the application of these codes of ethics in the workplace.

KEY QUESTIONS

- What is an example of an ethical conflict that might occur in a food science laboratory?
- How might these conflicts be resolved?
- What are some ethical issues related to professions in food science, food technology, or nutrition?
- What are some examples of ethical conflicts that might arise involving personnel working in the fields of food science, food technology, or nutrition?

Divide students into teams of three or four students. Have each team write a "code of ethics" for a workplace related to food science, food technology, or nutrition. The paper should give a description of the workplace environment (e.g., nutrition clinic, food science laboratory, food industry that employs food technologists).

KEY QUESTIONS

- What is a "code of ethics"?
- Why is a code of ethics important in occupational settings?

2) **GUEST SPEAKER**



Invite a family and consumer sciences professional to speak to the class on workplace ethics and characteristics desired by persons hiring food science and nutrition professionals. In advance, ask the speaker

NOTES

TA 129 Ethics in the Workplace

**TAAS
READING**

**TAAS
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NOTES

TA 84 *Guidelines for a Classroom Debate*

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to share examples of workplace ethics in his or her own job, and give fictitious scenarios of violations of workplace ethics for students to respond to as a class.



3) DEBATE

Guide students in preparing a debate on one of the ethical issues discussed previously. The students should be given opportunities to debate the issues from a variety of viewpoints, such as those of the dietitian, the client or patient, the food technologist, the laboratory technician, the president of the company owning the laboratory, etc. Have students use Teaching Aid 84, *Guidelines for a Classroom Debate*, for detailed information on preparing a debate.

KEY QUESTIONS

- What is the main issue?
- What evidence do you have to justify your conclusions?
- What are all the possible outcomes?
- Why is it important to analyze and evaluate ethical issues?

FCCLA ACTIVITIES

- FCCLA Career Connection: PLUG IN to Careers; ACCESS SKILLS for Career Success
- Power of One: A Better You; Working on Working
- STAR Events: Illustrated Talk; Skills for Life

RESOURCES

BOOK

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*, Chapter 2.

WEB SITES

American Association of Family and Consumer Sciences

www.aafcs.org

American Dietetic Association

www.eatright.org

Institute of Food Science and Technology

www.ifst.org/

Institute of Food Technologists

www.ift.org/

Internet Public Library

www.ipl.org

Virtual Reference Desk

www.refdesk.com

14F- The student is expected to practice problem solving, using leadership and teamwork skills.

1) GUEST SPEAKER/CLASS DISCUSSION



Invite a school administrator (principal or superintendent) or counselor to speak to the class on how skills related to teamwork and leadership are used in problem-solving situations in the workplace. Use the following questions as prompts for the guest speaker:

- How important are skills in teamwork and leadership to solving problems and meeting challenges related to your work?
- How important is it for team members and leaders to be able to resolve conflict constructively?
- What are examples of problem-solving situations where leadership and teamwork skills are used?
- What suggestions do you have for helping young adults develop and improve leadership and teamwork skills?

2) PROJECT/TEAMWORK



Review with students the problem-solving process using Teaching Aid 119, **Problem Solving**, and Teaching Aids 120a-b, **Solving Problems Through Effective Reasoning**. Divide students into teams. Write the following challenge on the board or transparency:

Kites are often used to illustrate problem-solving, themes, artistic creations, scientific phenomena, etc. Your team is challenged with designing a kite that illustrates or represents possible solutions to one of the following problems in our society:

- eating disorders
- diet-related diseases
- inadequate food supply
- childhood malnutrition
- hunger in America/establishing local food banks

Along with solutions to the problem, team members should consider factors associated with successful kite-making. A helpful Web site is Anthony's Kite Workshop at www.sct.gu.edu.au/~anthony/kites/.

Provide students with a variety of supplies for making their kites, such as fabric, string, yarn, paint, markers, paper, glue, glitter, ribbon, etc. After all teams have completed their kites, have a student volunteer from each team explain their kite as a response to their challenge with the class.

If students used materials that would actually enable their kite to fly, arrange for the class to fly their kites on the school grounds. This would provide students additional opportunities to utilize teamwork and leadership skills in flying the kite.

NOTES

TA 119 Problem Solving

TA 120a-b

**Solving Problems
Through Effective
Reasoning**

TAAS
READING

SCIENCE



NOTES

TA 130 Utilizing Leadership and Teamwork Skills



KEY QUESTIONS

- What leadership skills were exhibited during your work on the kite project?
- What teamwork skills were utilized?
- How effective was the problem-solving process in this project experience?
- How are the problem-solving skills in making a kite practiced in this exercise the same as or related to the problem-solving skills needed for solving workplace problems or problems in our society?
- What did you learn about the importance of leadership and teamwork skills?

3) INDIVIDUAL ACTIVITY

Assign students to look for opportunities to utilize leadership and teamwork skills in problem-solving situations over the next two weeks. Distribute copies of Teaching Aid 130, **Utilizing Leadership and Teamwork Skills**, to students and explain that they will use this document as a reporting form.

After students have completed the assignment, ask student volunteers to share their experiences. As a class, have the students suggest ways to develop and/or improve leadership and teamwork skills.

FCCLA ACTIVITIES

- FCCLA Career Connection: PROGRAM Career Steps; ACCESS SKILLS for Career Success
- Power of One: A Better You; Working on Working; Take the Lead
- STAR Event: Skills for Life

RESOURCES

PUBLICATIONS

Family, Career and Community Leaders of America, 1999. *Career Connection*.

Future Homemakers of America, 1999. *Leaders at Work Handbook*.

Future Homemakers of America, 1997. *Power of One Workbook*.

WEB SITES

Anthony's Kite Workshop

www.sct.gu.edu.au/~anthony/kites/

Internet Public Library

www.ipl.org

Virtual Reference Desk

www.refdesk.com

Food Science and Technology

Knowledge and Skills.

(15) Career preparation.

The student completes a supervised career-connections experience applying knowledge and skills developed in the study of food science and technology.

The student is expected to:

- (A) determine home and business applications of knowledge and skills developed in the study of food science and technology; and
- (B) utilize a career-connections experience to demonstrate occupational applications of competencies developed in the study of food science and technology.

15A- The student is expected to determine home and business applications of knowledge and skills developed in the study of food science and technology.

TO THE TEACHER

TEKS 15A and 15B are essential knowledge and skills for the supervised career-connections experience. Please refer to the section, *Supervised Career-connections Experiences*, in this instructional guide for examples of career-connections experiences for students enrolled in the Food Science and Technology course.

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NOTES

RESOURCES

15B- The student is expected to utilize a career-connections experience to demonstrate occupational applications of competencies developed in the study of food science and technology.

TO THE TEACHER

TEKS 15A and 15B are essential knowledge and skills for the supervised career-connections experience. Please refer to the section, *Supervised Career-connections Experiences*, in this instructional guide for examples of career-connections experiences for students enrolled in the Food Science and Technology course.

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RESOURCES

Supervised Career-connections Experiences

NOTE TO THE TEACHER

Ideas in this section provide examples of career-connections experiences for students enrolled in the Food Science and Technology course. Career-connections experiences are designed to be extensions of school-based learning through entrepreneurial, research, or work-based applications (work-based applications include home, business, or community contexts). This is an extended learning arrangement, comparable to work-based instructional arrangements for occupationally-specific courses. Career-connections experiences may be designed as a singular substantial project to be carried out over the scope of the semester or a series of short term activities. Regular supervision and reporting will be necessary throughout the course for successful completion of the career-connections experience.

Essential Knowledge and Skills:

- 15A The student is expected to determine home and business applications of knowledge and skills developed in the study of food science and technology.
- 15B The student is expected to utilize a career-connections experience to demonstrate occupational applications of competencies developed in the study of food science and technology.



FCCLA projects and programs have been suggested throughout the course that, depending on depth and extent, could constitute a supervised career-connections experience.

Supervised Career-connections Experience

- 2B- The student is expected to describe the impact of new technology on food science.*
- 3C- The student is expected to compare the effects of various cooking utensils and equipment on food products.*
- 3D- The student is expected to evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products.*
- 3E- The student is expected to apply the principles of food preparation to preserve quality and nutritive value of foods.*

THE STUDENT WILL:

1. Analyze the diet of one's self, friend, or family member for at least one week. Use a computer dietary analysis program, the Food Guide Pyramid, and other dietary guide lines to assist you in analyzing the diet.
2. Make a written plan to recommend changes to improve diet and activity levels.
3. Implement the plan for at least two weeks.
4. Re-evaluate the diet and check for improvements.
5. Set personal long-term goals for lifelong health and wellness. If analysis is for another individual, assist that person in setting health and wellness goals.
6. Summarize the project in writing explaining applications of knowledge and skills learned through this experience.

THE STUDENT WILL SUBMIT FOR EVALUATION:

- the computer dietary analyses
- the written plan for recommended changes
- the long-term goals
- a summary of the project experience, including #6 above
- a written and oral report of the project experience
- parent or guardian evaluation with signature

Supervised Career-connections Experience

- 2B-** *The student is expected to describe the impact of new technology on food science.*
- 3C-** *The student is expected to compare the effects of various cooking utensils and equipment on food products.*
- 3D-** *The student is expected to evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products.*
- 3E-** *The student is expected to apply the principles of food preparation to preserve quality and nutritive value of foods.*

THE STUDENT WILL:

1. Plan a menu for a special meal for family or friends. The meal should include a main entree, two vegetables, a salad, bread, dessert, and beverage.
2. Assemble recipes for menu items.
3. Prepare a market order of items needed for the meal preparation and service.
4. Shop for supplies recording the price of each item.
5. Figure the total cost of the meal and cost per person.
6. Conduct computer nutrient analysis of foods served to see nutrient content.
7. Prepare a schedule for food preparation and service.
8. Assemble table settings and food service tools and utensils.
9. Prepare and serve the meal.
10. Summarize the project in writing explaining applications of knowledge and skills learned through this experience.

THE STUDENT WILL SUBMIT FOR EVALUATION:

- the menu plan
- copies of recipes
- market order with price indicated for each item
- total cost of the meal and cost per person
- computer nutrient analysis of foods served
- the schedule of food preparation and service
- a photograph of table setting and meal (optional)
- a summary of the project experience, including #10 above
- a written and oral report of the project experience
- parent or guardian evaluation with signature

Supervised Career-connections Experience

- 1C-** *The student is expected to relate cultural food patterns to personal health.*
- 1D-** *The student is expected to analyze culturally diverse food choices that are nutritionally adequate.*
- 12B-** *The student is expected to determine the demands placed on food science and technology by American societal patterns.*
- 14C-** *The student is expected to demonstrate effective verbal, nonverbal, written, and electronic communication skills.*

In this project, students are to create a menu for a cultural food restaurant (students may wish to choose a cultural food restaurant other than those which are most common in your community such as Mexican, Italian, or Chinese restaurants). The menu must include appetizers, entrees, side dishes, breads, desserts, and beverages. Each category should have a minimum of three selections. Have students use computer word processing, desktop publishing, and/or computer graphics software to design and print their menus.

THE STUDENT WILL:

1. Select a cultural focus for the restaurant.
2. Research information on appropriate cultural foods.
3. Create a restaurant theme and design a menu using computer tools.
4. Conduct nutrient analysis of menu items using computer dietary analysis programs.
5. Summarize the project in writing describing the restaurant, cultural background of food items, types of foods served, and target customers. Explain applications of knowledge and skills learned through this experience.
6. Submit a reference list of resources used in this project.

THE STUDENT WILL SUBMIT FOR EVALUATION:

- the restaurant menu
- copies of computer nutrient analysis
- written report
- reference list
- a summary of the project experience, including #5 above
- a written and oral report of the project experience
- parent or guardian evaluation with signature

As an enrichment experience, have students design a school showcase on the nutritional adequacy of culturally diverse foods using an assortment of student-created menus as the focus of the showcase.

BLENDING ACTIVITY

- 3A- *The student is expected to apply science process skills in conducting laboratory activities.*
- 3B- *The student is expected to explain the chemical reactions that occur during food processing.*
- 3C- *The student is expected to compare the effects of various cooking utensils and equipment on food products.*

LABORATORY EXPERIMENT

Have students construct a solar oven and use it to cook food as a project in the food science laboratory. This experiment is adapted from the Department of Energy Web site: www.eren.doe.gov/solarnow/activ_3.htm.

Materials needed for each laboratory group:

one large pizza box	scissors
one small pizza box	heavy weight clear plastic laminate
old newspaper or other paper insulating material	non-toxic glue
black construction paper	pencil
cardboard	ruler
aluminum foil	non-toxic tape
drinking straw	

Note: Avoid using any materials that could give off toxic fumes when heating.

Procedure:

1. Line the bottom of the large pizza box with insulating materials like crumpled newspapers.
2. Set the small pizza box inside the larger one. (This will serve as the oven.)
3. Fill the space between the sides of the two boxes with crumpled newspapers.
4. Use cardboard pieces to fold over the insulated space between boxes; secure tightly.
5. Line the sides of the inner box with aluminum foil adhered with non-toxic glue.
6. Line the bottom of the inner box with black construction paper.
7. On the top cover of the small pizza box, draw a square, 1 inch from all four sides.
8. Cut along three of the lines but leave the fourth line near the box's hinge uncut.
9. Carefully open the flap.
10. Wrap a piece of aluminum foil around the flap, smooth out wrinkles, and secure with glue.
11. Tightly stretch the plastic laminate over the inside top of the box. Smooth the plastic and secure it around the sides with glue or tape so no air can escape.
12. Use straws to prop open the flap and allow aluminum lining to reflect the maximum sunlight.
13. Prepare the food. Bean and cheese burritos or "sun-grilled" cheese sandwiches work well. The oven can reach a temperature of 275°F. This is hot enough to cook some foods. Expect cooking time to take about twice as long as conventional methods. Allow the solar oven 30 minutes to preheat.
14. Have students prepare the same food item in the microwave oven and compare the results.
15. Have students compose a written evaluation of the learning experience.

BLENDING ACTIVITY

- 8A- *The student is expected to describe properties of microorganisms that cause food spoilage and food-borne illness.*
- 8B- *The student is expected to outline sanitation and food-handling practices that can help prevent food contamination and food-borne illness.*
- 8C- *The student is expected to describe functions of government agencies that regulate food quality, wholesomeness, and safety.*
- 8D- *The student is expected to analyze industry quality control standards and skills related to safety and safe working conditions.*

LABORATORY EXPERIMENT

Have students conduct a laboratory experiment to determine sources of bacteria and environments that promote the growth of bacteria that contaminate food products. Divide students into four laboratory groups or more if adequate supplies are available.

Materials needed for each laboratory group:

3x5 cards with laboratory instructions
8 petri dishes with sterilized nutrient agar jelly (check with science teacher for source)
8 wax pencils
Booklets on food safety available from USDA
Reference with illustrations of various bacteria
Teaching Aid 131, **Observations** (copy for each student)

Procedure:

1. Prepare the 3x5 cards for each group to use during the laboratory experience. On one side of the card write the following information:
 - 1) Use a wax pencil to divide the petri dish into four quadrants by drawing lines on the bottom of the dish.
 - 2) Use only three quadrants. The fourth will serve as the control. DO NOT TOUCH IT!
 - 3) Complete the group assignment for the next three quadrants.
2. Write the following instructions on the other side of the cards; one card for each laboratory group.

Group 1:

 - a. Press the back of a clean spoon in one quadrant of the petri dish.
 - b. Lick the spoon and press it into another quadrant.
 - c. Drop a clean spoon on the floor and press it into the third quadrant.
 - d. Place the lid on the petri dish, label, and place in a kitchen cabinet.
 - e. Repeat the process with a second dish and place in the refrigerator.

Group 2:

 - a. Press unwashed finger in one quadrant.
 - b. Wash hands with soap and water. Dry on clean towel or paper towel. Press finger in a second quadrant.

- c. Blow nose into tissue. Do not wash hands. Press finger into the third quadrant.
- d. Place lid on dish, label, and place in a kitchen cabinet.
- e. Repeat process with a second dish and place in the refrigerator.

Group 3:

- a. Press a section of a clean, wet dishcloth onto one quadrant.
- b. Wipe the inside of the sink and counter with a cloth and press into a second quadrant.
- c. Wash hands and dry on a clean towel. Press a damp section into a third quadrant.
- d. Place lid on the dish, label, and place in a kitchen cabinet.
- e. Repeat process with a second dish and place in the refrigerator.

Group 4:

- a. Press a fresh piece of luncheon meat, handled with a fork, into the first quadrant.
 - b. Press a second piece of luncheon meat, which has been left at room temperature for several hours, into a second quadrant.
 - c. Use your hands to press a fresh piece of luncheon meat into the third quadrant.
 - d. Place a lid on the dish, label, and place in a kitchen cabinet.
 - e. Repeat process with a second dish and place in the refrigerator.
3. In three to five days, check the petri dishes to see if they are ready to be evaluated. When they are ready, have students evaluate the results using Teaching Aid 131, **Observations**. All students should examine all petri dishes. Lead a class discussion on each group's findings and summarize as a class the conditions which promote the growth of bacteria. Have students generate a list of do's and don'ts regarding safe care and handling of food products.

BLENDING ACTIVITY

Note: Many of the student expectations for Food Science and Technology will be enhanced by the Food Science Fair project.

3A- The student is expected to apply science process skills in conducting laboratory activities.

10D- The student is expected to utilize research methods to create projects related to a current issue in food science, technology, and nutrition.

14C- The student is expected to demonstrate effective verbal, nonverbal, written, and electronic communication skills.

PROJECT/FOOD SCIENCE FAIR

1. Each student will conduct a science experiment, demonstration, or write a research paper on a topic related to food science and technology.
2. Science experiments and demonstrations must follow the scientific method of investigation.
3. Research paper projects will include a visual display.
4. Science experiments and demonstrations will include a written report of the experience.
5. All projects will include a complete bibliography.
6. The students can set up the fair in the food science classroom, cafeteria, or other location for sharing with the faculty and student body. If possible, open the food science fair during the evening so students can invite parents, guardians, and friends. Students would be present to discuss their projects with food science fair visitors.

PROJECT IDEAS

- Compare the effect of a variety of fats and oils on baked products.
- Conduct experiments on yeast products with and without preservatives to determine shelf life and palatability.
- Compare nutritive value and cost of selected foods available from health food stores versus traditional supermarkets.
- Compare shelf life of pre-packaged salad greens with non-packaged salad greens.
- Conduct personal or family food recall for one week and use computer dietary analysis to determine the amount of fat, sugar, and salt in the diets of family members. Compare the results with recommended amounts.
- Compare the typical American adolescent diet with that of adolescents in a developing country.
- Determine why malnourished individuals take longer to heal after an injury than a well-nourished individual.
- Determine methods for retaining pigments (anthocyanins: red; anthoxanthins: white; carotenoids: orange or yellow; and, chlorophyll: green) in vegetables.
- Test a variety of methods (antioxidant solution, ascorbic acid solution, sugar solution, salt solution) for preventing browning of fruits, such as apples, bananas, and pears.
- Determine the appropriate cooking time for hard-cooked eggs for optimum product color and quality. Determine how to prevent the discoloration caused by the reaction of iron in the yolk and hydrogen sulfide in the egg white.

BLENDING ACTIVITIES

Integration of FCCLA

CAREER CONNECTION

Have students use the *Career Connection* workbook, available from FCCLA National Headquarters, to explore careers, to learn the career development process, and to understand and prepare for the interaction among careers, families, and community. Members can receive recognition for their accomplishments.

TEKS 13A-13C

CHAPTER ACTIVITIES

Have students plan and present a program on food safety and sanitation for various groups in the community, such as youth groups, child care providers, and elder care facilities.

TEKS 8A-8D

COMMUNITY SERVICE PROJECT

Students could participate in several activities related to promoting good health and nutrition such as:

- collect funds and/or food for the local food bank or food pantry
- volunteer at the local food bank and/or food pantry
- create posters to display in the school cafeterias, grocery stores, etc., which promote awareness of the food supply and world hunger
- write articles for the local newspaper featuring food supply, distribution, and nutrition from a global perspective

TEKS 1B, 6B, 11B-11D,
12B, 12C, 12F, 12G

POWER OF ONE

Working on Working: Have students interview professionals in nutrition, food science, and food technology (e.g., food technologist, health inspector, foodservice manager, dietitian). Students could then research careers in these areas. Have students list personal attributes, qualifications needed, and the rewards and demands of careers in nutrition, food science, and food technology.

TEKS 13A-13B

STAR EVENTS

Applied Technology: Students could use dietary analysis software to help individuals (e.g., other students, teachers), including those with special dietary needs, plan nutritious meals and snacks.

TEKS 5A, 5D, 5E

Focus on Children: Students could provide reliable information on nutrition or food safety and sanitation to preschool and school-age children through puppetry, posters, or other media. Flyers or brochures also could be developed and provided to parents.

TEKS 6A, 6B, 8A, 8B

BLENDING ACTIVITIES

Integration of FCCLA

STAR EVENTS

Illustrated Talk: Ideas for illustrated talk topics could include:

- Cultural Foods for Healthy Eating
- Consequences of Eating Disorders on Long-term Health and Wellness
- The Relationship of the Food Supply to the Quality of Life

TEKS 1A-1D, 5C, 11B, 12C

STUDENT BODY

Have students work with the athletic department to evaluate the diets required of participants in various sports. Help athletes determine a dietary plan for their individual weight and nutrition goals.

TEKS 5A, 5E



NOTE TO THE TEACHER

Developers of the series of instructional guides for implementing Texas Essential Knowledge and Skills for Family and Consumer Sciences Education faced a twofold challenge: (1) to write instructional strategies that enable students to acquire the stated essential knowledge and skills and (2) to help teachers deliver the strategies in ways that promote active learning, relevance, and retention in students.

After a great deal of experimenting and discussing, the following system seems best to address the twofold challenge, while providing maximum flexibility for you, the teacher, whom we consider the ultimate instructional expert in your classroom.

- The nature of the content of family and consumer sciences provides wonderful opportunities for hands-on, relevant learning by students, and in many cases the instructional strategies themselves facilitate active learning.
- Teaching and learning activities in the instructional strategies section have been presented as briefly as possible. For instance, the strategy may state "Have students work in groups to ...," but no specific suggestions for grouping students are provided.
- The **Creative Ideas** section has been included to provide you with suggestions and examples of ways to enhance some basic techniques included in the **Instructional Strategies** section. For example, it does provide several specific suggestions for grouping students.
- The **Blended Activities** section promotes student learning of multiple TEKS through hands-on, project-based, and/or problem-solving activities.
- Integration of FCCLA activities as appropriate throughout the instructional strategies and blended TEKS activities promotes student learning through relevance and application.

We strongly encourage you to:

- Read this section! Not only will it provide ideas for promoting active learning, but it will provide additional suggestions for saving teacher time and enhancing student learning and skills development.
- Link appropriate creative teaching techniques to specific instructional strategies in your Teacher's Instructional Guide.
- Adapt the instructional strategies and creative teaching techniques to fit your district needs, the needs and learning styles of your students, and your own teaching style.
- Add to this section! Resources that offer creative teaching ideas are readily available. Professional development conferences continually offer sessions that promote active learning, authentic assessment, varied learning styles, etc.

This section provides only a small sampling of creative ideas for teaching techniques!

Creative Ideas



GROUP ACTIVITY/TEAMWORK

When to use: In activities where teamwork facilitates generation of ideas and higher-order learning. Working in groups also meets needs of students with global learning styles.

Skills reinforcement: Teamwork and leadership skills, communication skills, interpersonal skills

Methods of grouping students:

There are many methods of randomly assigning students to groups. Several examples are provided below. You can pick up other ideas through brainstorming, networking, and personal participation in group activities. (Note that methods will vary depending on the number you want in each group.) Dividing students into groups can be a quick way to inject some fun into an activity.

- **Count Off.** Have students count off 1 through however many groups are needed, repeating until all students have a number. Select a location for all "1s" to work, all "2s", etc.
Variation – write the numbers on cards and have students draw.
- **Geography.**
 - For pairing students, have them draw cards with names of states and capitals. Students find the classmate with the matching state or capital.
 - Have students draw from cards with names representing geography sets, such as names of continents, oceans, countries, rivers, etc. Students will need to figure out what their name represents and find the others with cards in the same set.
- **Course content.** (Similar to the above activity, except using concepts from the course.)
 - For pairing students, have them draw cards listing either elements and principles of design or corresponding definitions. Students find the classmate to match the term and definition.
 - Have students draw from cards representing nutrition sets, such as foods from different food groups. Students find others with cards in the same set.
- **Famous Fictional Characters.** Have students draw cards with names of characters from literature they have recently studied in Language Arts, famous fictional characters (such as characters from Peter Pan or The Wizard of Oz), well-known television shows, etc.
- **Puzzles.** Purchase or create puzzles, mix up the pieces, and have students find group members with matching puzzle pieces. Hint -- If you have puzzles with more pieces than needed for group members, pull out the number of pieces needed for students to draw, leave the remaining pieces on the table where the group will meet, and have students circulate among tables until they find their correct puzzle and meet up with other group members.
- **Deck of Cards.** A deck of cards (or multiple decks) can be used in many ways to form various sizes of groups. Students can form groups based on suits, colors, face cards, or combinations (such as a full house or four-of-a-kind).
- **Candy Flavors.** Have students group according to flavors of candy or colors, for example, M&Ms. This provides students with a nice treat also!
- **Self-selection.** Allow students to select their own group members. Have students group with students nearby or find students with whom they have not recently worked.

GROUP ACTIVITY/TEAMWORK (Continued)

Suggestions for Effective Group Activities:

The size, structure, and function of a group will differ depending on specific objectives of the activity. Following are a few suggestions for helping students work most effectively in groups.

- Clarify expectations. Make sure all group members know what is expected of each person individually and what the group is expected to accomplish as a whole.
- Set time limits. Let groups know up-front how long they will have to work. If it is a lengthy activity, provide time checks periodically. Let groups know when they have one to two minutes remaining, and signal when time is up. Examples of signals include flipping a light switch, clapping, using a sound signal (bell, kazoo, train whistle, etc.), or playing music.
- Make individual assignments where appropriate to the activity. Possibilities include leader or facilitator, recorder, timekeeper, or runner.
- Emphasize the importance of each member's contributions, through participation, encouragement, focus on the task, and contribution to the final product. Build in individual accountability.

Build in individual accountability!

When participating in engaging, active learning experiences, it is important that students understand that they are accountable for learning. It may be tempting for students, when working in groups, watching a video, or listening to a guest speaker, to view the experience more as a "fun activity" than as a learning experience. While the experiences are intended to be enjoyable, students need to understand that the underlying purpose is to enable them to acquire essential knowledge and skills.

Following are suggestions for building individual student accountability into group and teamwork activities, as well as classroom discussions, videotape viewing, guest speakers, educational tours, etc.

- Set the stage for learning. Frame each activity within the context of essential knowledge and skills students are expected to acquire. In other words, help them up front to see the relevance of learning activities.
- Structure the group to promote accountability. For example, each student within the group could be assigned a specific role. Or each member might be responsible for a specific part of the product. Provide a means of assessing each student's effectiveness.
- Vary the methods through which students report group findings and results. For example, if there is one "reporter," other group members may not feel as accountable as that designee. If, however, the teacher randomly calls on group members for reports, all members will need to be prepared. Provide an occasional variance by having group members return to their desks and write individual accounts of group results.

It should not be necessary to implement such suggestions for every activity. By varying the process, randomly calling on groups or individuals, occasionally requiring written accounts, etc., the teacher sends the message that students are individually accountable and need to be involved and attentive.

Creative Ideas



RESOURCE PERSONS (GUEST SPEAKER/PANEL DISCUSSION)

When to use: Good for providing information not readily available in textbooks, information that is new, or that which is best presented in a "real-world" perspective. With new information becoming available so rapidly, this method offers unique opportunities to provide students with the latest perspectives. It also provides students with opportunities to hear information straight from "experts," promoting credibility and relevance to students.

Skills reinforcement: This method provides rich opportunities for promoting a variety of skills. The following suggestions provide students excellent practice for improving and applying verbal, nonverbal, written, and electronic communication skills. Rotate these responsibilities throughout the semester so various students have an opportunity to perform different tasks. (The following suggestions can also save the teacher much time!)

- Have students help make initial contacts with the guest speaker or panel participants. Let students practice or role play making contacts via telephone or in person. Work with them to initiate and follow through on actual contacts.
- Have students introduce the topic and guests. Guide students in writing appropriate introductions for speakers or panel members. Make sure students are prepared to make the actual introduction before the presentation.
- Have one or more students write each participant a thank-you note expressing appreciation from the class. You may suggest that the note be handwritten and point out the appropriateness of personalized, handwritten thank-you notes. Or students may utilize computer applications to compose the note. Have students create a class letterhead for correspondence.

Suggestions for maximizing guest resources: Teachers have expressed that it is time-consuming to arrange for several guest speakers or panels each semester and that they do not want to call upon the same persons frequently. Use student participation as suggested above to save teacher time. Use technology to expand access to resource persons and to build a resource file for future reuse.

- Videotape the classroom presentation by the speaker/panelists. The videotape can be viewed by students who may have been absent and can be added to a resource file for use with later classes. This eliminates the need to arrange for several "live" presentations each semester. This is especially critical in small communities where the same "experts" would likely be called upon time after time.
- Utilize videoconferencing facilities to connect students in the classroom with the speaker/panelists in another location. Record the videoconference for review and reuse. This can be especially helpful in small communities where resource persons for various topics may not be available.
- Videotape or audiotape the resource persons at their locations, or audiotape (with permission) responses to information inquiries over the telephone.

Alternative: Have students conduct audiotaped interviews to solicit information and present the information in the format of a television newscast or documentary.

Creative Ideas



ORGANIZING AND PRESENTING INFORMATION: VISUAL DISPLAYS, BROCHURES/FLYERS, PRESENTATIONS

When to use: As students research and collect varied information, these techniques enable them creatively to compile and organize; to share information with classmates and potentially other audiences.

Skills reinforcement: Depending on how the activity is structured – communication skills (verbal, nonverbal, written, electronic); teamwork and leadership skills; interpersonal skills; management and problem-solving skills; organizational skills

Suggestions for effective visual displays and presentations:

- Incorporate the use of computers and technology applications where appropriate.
- Choose techniques that fit learning objectives; in some cases, that might best be students in groups writing ideas on large sheets of paper to be posted around the room. Or it may be a multimedia presentation to be presented at an all-school assembly.
- Some activities may best be done individually; some by groups. Consider learning objectives, as well as learning styles of students.
- Visual displays and presentations provide an opportunity for authentic assessment of student learning on a topic.
- Allow students to generate ideas for organizing and presenting information.
- Where feasible and appropriate, keep outstanding student products for future use.

Miscellaneous ideas for organizing and presenting information:

- listing of ideas on large sheets of paper
- display of items (i.e., sewing notions for clothing repair)
- graffiti mural where students take markers and share key points learned
- bulletin board
- overhead transparency
- *large index cards for recording information from research, interviews, observations, and bibliographic information from printed references
- *graphic organizers for effectively organizing ideas and research findings
- brochure/booklet describing information about a topic; Teaching Aids 88a-b, **Brochure Assessment**, provide a tool for evaluating the effectiveness of a brochure
- flyer/circular promoting key points related to a topic
- bookmark citing useful information about a topic
- newsletter
- oral presentation (vary through skit, monologue, or puppet presentation)
- written presentation
- poster presentation (sharing research findings)
- videotape presentation
- photo album or display
- multimedia presentation utilizing a combination of print and electronic media

* Detailed suggestions for compiling and organizing information are included in Appendices G and H of *Independent Study in Home Economics Education*, available from The Curriculum Center for Family and Consumer Sciences. An example of a web diagram is shown in Teaching Aid 38, **Web Diagram**.

Creative Ideas



CASE STUDIES AND SCENARIOS

When to use: As a tactful way to address sensitive issues. Allows students to express their views and examine the views of others in a non-judgmental manner around hypothetical, fictional situations.

Skills reinforcement: Problem-solving; creative and critical thinking; verbal, nonverbal, and written communication skills; leadership and teamwork skills

Case studies and scenarios are very similar in nature, and the terms are often used interchangeably. Both describe hypothetical circumstances and characters, and both set up a situation for analysis and application of problem-solving skills. As presented in this instructional guide, a case study provides more details about a specific situation and each character involved. A scenario is a brief synopsis of a set of circumstances or sequence of events.

Suggestions regarding case studies and scenarios:

- Where case studies or scenarios have been provided with the instructional strategy, read them to be sure they are appropriate for your instructional environment and local district policies. You may choose to adapt them or have students write new ones.
- Writing original case studies or scenarios is a good opportunity for students to create situations related to the topic that are most relevant to them. The writing experience also develops communication skills and provides TAAS reinforcement.
- Remind students that case studies and scenarios should be written as fictional.
- Newspaper articles and periodicals, such as parenting and family magazines, can provide stimulating ideas for case studies and scenarios.
- Case studies and scenarios can be presented in creative formats, such as that of an advice column or an "Ask an Expert" column.
- Use case studies and scenarios written by students to build a resource file for future use.

Creative Ideas



LISTENING TEAMS

When to use: To promote attentiveness during presentations by guest speakers or panels, videotapes, observation assignments, or other viewing/listening activities. Requires students to listen specifically for certain points or ideas.

Skills reinforcement: Communication skills, especially listening; leadership and teamwork

Suggestions for effective use of listening teams:

Prior to a presentation, lecture, or videotape, divide students into listening teams. Give each team a specific assignment or role, so they will know up-front what they need to listen for. Let students know they will be responsible afterwards for reporting to the class, in writing or orally, the results of their assignment. Examples of listening team assignments or roles include the following:

- Provide students with a list of topics to be covered. Assign each team one or more specific topic(s) for which to listen during the presentation. Have them summarize key points related to their assigned topic following the presentation.
- Have each listening team write questions related to an assigned topic prior to the presentation. Students must listen during the presentation for answers to questions they wrote.
- Assign each team a specific role during the presentation. For example, one team might prepare questions based on information presented, another might summarize the five most important points, another might identify issues for further discussion or clarification, etc.



DEBATE

When to use: When there are two sides to an issue – pros and cons, advantages and disadvantages, etc. Debate promotes critical thinking and requires students to research, look at all sides of an issue, and draw conclusions.

Skills reinforcement: Communication skills; critical thinking skills; research skills

Clarification and suggestions related to classroom debates are provided in Teaching Aid 84, ***Guidelines for a Classroom Debate***.

Creative Ideas



BRAINSTORMING

When to use: When you want students quickly to generate as many ideas as possible about a topic; to get ideas "on the table" before discussing or analyzing them. Useful when you want to begin with students' ideas or understanding about a topic.

Skills reinforcement: Communication skills

Suggestions for effective brainstorming:

Create an environment where students feel free to let ideas flow freely. The brainstorming process is not the time for discussing or critiquing input.

Brainstorming variations:

- Have a student volunteer record ideas as they are generated by members of the class.
- Have students work in small groups to brainstorm ideas on a topic. Lead groups to take turns sharing ideas.
- Have individuals brainstorm ideas by writing them on small post-it notes. Then have students post the notes around the room. This works well when ideas later need to be categorized.
- Popcorn Planning: Have students think of themselves as part of a giant popcorn popper; have them jump up and share ideas as they come. Serve popcorn at the close of the lesson. (Idea from Janis P. Meeks, *Time to Teach* series.)



GAMES

When to use: Good when students need to learn or review facts and details. Provides a fun way to commit details to memory and practice recalling.

Skills reinforcement: Communication skills; interpersonal skills; games involving team competition promote leadership and teamwork skills

Suggestions for games:

Instructions for a Jeopardy game are provided in Teaching Aid 14, "**Jeopardy**" *Game Instructions*. Ask students to suggest other game formats they would enjoy using, and let them develop the games and make up a clever title for each game. Writing clear instructions and verbally explaining them will be excellent practice of communications skills. The process of preparing questions or facts to be used in the game will require researching and reviewing content information, thus promoting learning.

Creative Ideas



INTERNET ACTIVITIES

When to use: In locating new, updated information; to enhance or replace information provided by references and textbooks, which may be outdated.

Skills reinforcement: Communication skills (written and electronic); research skills

The Internet provides hands-on opportunities for students to research information through a medium with which most of them are familiar. Following are miscellaneous suggestions related to creative use of the Internet in instruction:

- The convenience of Internet access will vary among school districts. Your students may have access to the Internet in various classrooms, in a computer lab or library, or in many of their homes. Assignments related to Internet research should be structured accordingly.
- Student skills in exploring the Internet will also vary (as will skills of teachers). You may want to invite a resource person to assist students with the first assignment involving Internet search, or plan an educational tour to a computer lab where students can conduct the assignment under supervision of someone with Internet expertise.
- Review common Internet terminology, such as terms defined on Teaching Aid 132, **Internet Terminology**.
- Provide students with guidelines regarding Internet use and safety. Some accepted rules of conduct for Internet users are provided in Teaching Aid 133, **Netiquette**.
- If the majority of students are not experienced in using the Internet, begin by assigning a specific Web site for them to visit for information related to a specific topic. Have students summarize key information learned from the Web site. If the site has hyperlinks, ask students to check them out to see what additional information the sites lead to.
- As students become more experienced, have them conduct Web searches, using available Web browsers or search engines. When students conduct Web searches, remind them to:
 - note what key words were used, most especially those that worked to locate information
 - take notes about the topic they are researching, and print out information as appropriate (Have students be sure to note on any printouts the Web address of the source. This is important for bibliographic reference and to be able to return to the site later for clarification or further information.)
- It is also helpful to diagram the path of a Web search. Begin the diagram with the name and Web address of the browser used to search. Plot the name and Web address of each location along the path of the search. This will facilitate relocation of informative sites in the future.
- Use the expertise of students to teach other students, and even the teacher, Internet skills!

Creative Ideas



LET STUDENTS HELP!

When to use: To promote student involvement, provide an opportunity for skills development, capitalize on student skills and creativity, and save the teacher time! Also, since each teacher has a preferred learning style, involving students broadens the types of learning experiences to meet the needs of students with learning styles that differ from those of the teacher.

Skills development: Provides a multitude of opportunities for promoting various skills, including communication (verbal, nonverbal, written, and electronic); teamwork and leadership; interpersonal; management and problem-solving; organizational

The following are just a sampling of ideas for student involvement in planning and implementing instructional experiences. Be sure to work with students to prepare them to perform each task successfully. This may entail practicing or role playing situations in advance. And, of course, supervise students to ensure appropriateness and accuracy of information gathered.

Examples of tasks students can perform include the following:

- Make contacts to arrange for guest speakers or panelists.
- Help with classroom correspondence; for example, write thank-you notes to guest speakers, persons who helped with learning tours, and other supporters of class projects and activities.
- Write for information on topics or products. (Provide students with resource lists, or have them help conduct Web searches to locate sources of information on topics.)
- Audiotape or videotape interviews on location with resource persons.
- Videotape segments of movies or television shows illustrating relevant concepts.
- Provide CDs/songs that relate to the lesson (to be played in opening or closing a lesson, or to emphasize a specific point – good for global learners!).
- Perform Web searches.
- Clip newspaper articles relevant to lessons. (Create an "In the News" resource file for ongoing use.)
- Collect examples of items to reinforce classroom learning, such as food labels, appliance use and care manuals, clothing labels, credit card terms and solicitation letters, etc.
- Design bulletin boards.
- Help find cartoons, relevant or humorous quotes, anecdotes, and jokes relevant to topics.
- Develop games for use in learning or reviewing factual material.
- Write test or review questions on material covered.
- Develop project criteria and rubrics.

Resources

America's Career InfoNet
www.acinet.org/

American Academy of Pediatrics
www.aap.org

American Association of Family and Consumer Sciences
1555 King Street
Alexandria, VA 22314-2752
(703) 706-4663
www.aafcs.org

American Association of Family and Consumer Sciences. (1993). *Handbook of Food Preparation* (9th Ed.).

American Cancer Society
1599 Clifton Road NE
Atlanta, GA 30329
(800) 227-2345
www.cancer.org

American Diabetes Association
www.diabetes.org

American Dietetic Association (ADA)
National Center for Nutrition and Dietetics
216 West Jackson Blvd.
Chicago, IL 60606-6995
www.eatright.org

American Heart Association
7272 Greenville Avenue
Dallas, TX 75231
(214) 373-6300
(800) 242-8721
www.amhrt.org or www.americanheart.org

Anorexia Nervosa and Related Eating Disorders, Inc.
www.anred.com/

Anthony's Kite Workshop
www.sct.gu.edu.au/~anthony/kites/

Aunt Edna's Kitchen
www.cei.net/~terry/auntedna/

Bread for the World
www.bread.org/

Cancernet (See National Cancer Institute)
www.cancernet.nci.nih.gov

Center for Disease Control and Prevention
www.cdc.gov

Resources - Continued

Center for Science in the Public Interest
www.cspinet.org

CNN
www.cnn.com/food/news

Cornell University
www.news.cornell.edu/eg.acgi

The Curriculum Center for Family and Consumer Sciences
Texas Tech University
Box 41161
Lubbock, TX 79409-1161
(806) 742-3029
www.hs.ttu.edu/ccfcs

The Curriculum Center for Family and Consumer Sciences, 2000. *Food Science and Technology Reference Book*. Lubbock, TX: Texas Tech University.

Dictionaries
www.onelook.com

Dictionary of Occupational Titles
www.dott.net/upg/immigration/dot_index.html

Duyff, Roberta Larson, 1998. *The American Dietetic Association's Complete Food and Nutrition Guide*. Minneapolis, MN: Chronimed Publishing.

Education Service Centers. (Contact local school district office for phone numbers.)

The Electronic Library
www.elibrary.com
www.newstrawler.com

Extension Food and Human Nutrition
agweb.tamu.edu/ansc/nutr/nutr.htm

Family, Career and Community Leaders of America, Inc.
1910 Association Drive
Reston, VA 22091
(800) 234-4425
www.fccla.org

Family, Career and Community Leaders of America, Inc.
Texas State Association
8140 Burnett Road
Austin, TX 78766
(512) 459-3269

Family, Career and Community Leaders of America, Inc. 1999. *Career Connection*.

Feed the Children
www.feedthechildren.org/

Resources - Continued

Felstehausen, G., 1999. "Managing Multiple Roles." *Essentials for Home Economics Education: The Cornerstone*. Lubbock, TX: Home Economics Curriculum Center, Texas Tech University.

FitLife
<http://fitlife.com>

Food Allergy Network
10400 Eaton Place
Suite 107
Fairfax, VA 22030
(703) 691-3179
www.foodallergy.org

Food and Agricultural Organization of the United Nations (FAO)
www.fao.org/

Food and Drug Administration (FDA)
Consumer Information Office
5600 Fishers Lane, HFE 88
Rockville, MD 20857
(301) 443-3170
www.fda.gov

Food and Nutrition Board of the National Academy of Sciences
2101 Constitution Avenue, SW
Washington, DC 20418
(202) 334-1732
www2.nas.edu/fnb/

Food and Nutrition Information Center/USDA
National Agricultural Library
Room 304
20301 Baltimore Avenue
Beltsville, MD 20705-2351
(301) 504-5719
www.usda.gov/fnic

Food Finder
[www.olen.com/food](http://www olen.com/food)

Food Safety
www.foodsafety.gov/

Fortin, F., 1996. *The Visual Food Encyclopedia*. Canada: Macmillan, Inc.

Functional Foods for Health, University of Chicago
www.ag.uiuc.edu/~ffh/ffh.html

Future Homemakers of America, Inc. 1999. *Leaders at Work*.

Future Homemakers of America, Inc. 1997. *Power of One*.

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Resources - Continued

Home Economics Curriculum Center, 1997. *Skills for Life*.

Home Economics Curriculum Center, 1999. *Essentials for Home Economics Education: The Cornerstone*.

The Hunger Project

www.thp.org/

Institute of Food Science and Technology

www.ifst.org/

Institute of Food Technologists

www.ift.org/

International Food Information Council (IFIC)

<http://ificinfo.health.org>

The Internet Chef On-line Magazine

www.ichef.com

Internet Public Library

www.ipl.org

Kittler, P.G. and Sucher, K.P., 1998. *Food and Culture in America*. Belmont, CA: Wadsworth Publishing Company.

The Library of Congress

www.locweb.loc.gov

Library of the Workplace

www.cord.org/workplacelibrary

Look Smart

www.looksmart.com

Merriam Webster Dictionary

www.m-w.com/dictionary

The Mining Company

<http://miningco.com>

Monster Board

www.monster.com

National Association of Colleges and Employers

www.jobweb.org

National Cancer Institute

National Institutes of Health

31 Center Drive, Building 31, Room 10A07

Bethesda, MD 20892

(800) 422-6237

www.cancernet.nci.nih.gov

Resources - Continued

National Center for Education in Maternal and Child Health
www.ncemch.georgetown.edu/

National Eating Disorders Organization
6655 South Yale Avenue
Tulsa, OK 74136
(918) 481-4044
www.kidsource.com/nedo/

National Health Information Center
nhic-nt.health.org

National Institutes of Health
www.nih.gov/health

National Osteoporosis Foundation
www.nof.org

Neill, L.A. "Portfolio Development for Secondary Students," 1998. *Essentials for Home Economics Education: The Cornerstone*. Lubbock, TX: Home Economics Curriculum Center, Texas Tech University.

Nutrition Navigator, Tufts University
navigator.tufts.edu

Nutritional Analysis Tool, University of Illinois
www.ag.uiuc.edu/~food-lab/nat/

Occupational Outlook Handbook
<http://stats.bls.gov/ocohome.htm>

Office of Biotechnology, FDA
www.fda.gov

Online Career Center
www.occ.com/occ/

Partnership for Food Safety Education
www.fightbac.org

Research It!
www.itools.com/research-it/research-it.html

The Riley Guide
www.rileyguide.com

Save the Children
www.savethechildren.org/

Science Surf
www.weber.u.washington.edu/~wcalvin/scisurf.html

Texas Agricultural Extension Service
agextension@tamu.edu or www.fcs.tamu.edu

Resources - Continued

Texas Department of Health
www.tdh.texas.gov/

UNICEF
www.unicef.org/

United States Department of Agriculture (USDA) (see Food and Nutrition Information Center)
www.usda.gov

United States Department of Health and Human Services
www.healthfinder.gov

Universities on the Net
www.universities.com
www.clas.ufl.edu/CLAS/american-universities.html

Utah State Office of Education (utahlink)
www.uen.org/utahlink/

Virtual Reference Desk
www.refdesk.com

What Color Is Your Parachute?
www.washingtonpost.com/parachute

World Health Organization
www.who.org/

World Trade Organization
www.wto.org/

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Tips for Teachers: Laboratory Experiences in Food Science and Technology

- 1) The instruction which students receive in the Food Science and Technology course may be the only formal education they will ever have in nutrition and food science. Plan for essential learning experiences.
- 2) Instruction in nutrition and food safety should be a part of each experience planned for food science and technology classes. Laboratory experiences should be used to build nutrition and food science concepts and management skills. These experiences should be interspersed throughout the course. The teacher should avoid separation of instruction in nutrition and food science from that of food preparation.
- 3) Priorities for necessary principles which must be taught should be set before laboratories are planned.
- 4) Each laboratory experience should be evaluated in terms of the knowledge and skills which will be reached for each student who participates. For example, if four students are in a group and only one has the experience of kneading dough, then only one student will develop the skill of preparing dough properly. The other students missed the experience.
- 5) Integrate concepts which require short periods for development as multiple activities in the laboratory. For example, teach management skills along with food science concepts.
- 6) Each member of a laboratory group should have some responsibility during each laboratory experience.
- 7) In deciding whether each laboratory group is to conduct the same experiment or prepare the same product in a laboratory experience, be guided by the objectives for the class. If the objectives are to develop a specific principle, then each group must conduct the same experiment. If the objective is to see results of a variety of procedures or see variety available within a certain category, then different laboratory units should conduct different experiments. For example, if the objective is to test the effect of microwave energy on the color and tenderness of broccoli, then each laboratory group should prepare broccoli. However, if the objective is to see the effect of different cooking methods on the color and tenderness of broccoli, then each laboratory group should prepare broccoli using a different method.
- 8) Demonstrate new science laboratory skills or food preparation techniques before each laboratory experience. If students do not have the skill, a demonstration will better ensure their acquiring the skill. When giving a demonstration, provide each student with a copy of the instructions used.

Tips for Teachers: Laboratory Experiences In Food Science and Technology, Cont'd.

- 9) Planning prior to the beginning of the course is absolutely essential for effective use of resources.
- 10) Many beneficial learning experiments occur following the laboratory experience. For example, after an experience testing the effectiveness of leavening agents on baked products, the teacher should follow with activities similar to the following:
 - Discuss the nutritional value of the foods in the Breads, Cereal, Rice and Pasta group.
 - Point out the major nutrients and their functions in the body contributed by baked products.
 - Have students suggest ways to make baked products more nutritious.
 - Display results of experiments on bulletin boards in the classroom.
- 11) Evaluations which follow laboratory experiences should be much broader than just checking for results of the experiment, quality of product, and efficiency in preparation.

Rules for Personal Hygiene and Sanitation in the Food Science Laboratory

1. Wash your hands thoroughly with soap and warm water. It is the number one rule in disease prevention. Dry your hands on paper towels and dispose of the paper towels.
2. Avoid touching your face, hair, skin, or unsanitary objects. Keep your hands away from your face (eyes and mouth especially) when handling chemicals in the food science laboratory.
3. If your hands have open cuts or sores, wear plastic gloves or do not work with food preparation or food service tasks. Likewise, do not work in the food science laboratory if you are ill.
4. Repeat handwashing as often as necessary, but especially after coughing, sneezing, or using the toilet.
5. Hair should be clean, and long hair should be put up or tied back.
6. Clothing should be clean. Avoid jackets, long, loose sleeves, or dangling jewelry. It is best to wear shoes with full foot protection in the food science laboratory.
7. Wear a clean apron or lab coat during all food science experiments and clean up tasks.
8. Do not eat or drink any substance in the food science laboratory unless you have permission from your teacher to do so.
9. Use only clean towels and dishcloths in the food science laboratory; obtain a clean supply at the beginning of the class period.
10. Use extreme caution and care when handling microorganisms grown in a petri dish or test tube. Follow the correct laboratory sterile techniques when transferring microorganisms to a slide for the microscope or from one culture to another.
11. Wash and dry all tables and countertops at the beginning and ending of each laboratory experience.

Rules for Cleanliness in Food Preparation Areas

1. Keep the food preparation area clean.
2. Always use **clean** utensils, bowls, and other food preparation equipment.
3. Never use dish towels to wipe spills, the floor, or for anything other than drying dishes. Use paper towels for drying hands.
4. Wash and dry dishes properly using the following techniques:
 - a. Scrape all garbage from dishes and place in proper containers.
 - b. Rinse to remove small food particles and sauces.
 - c. Stack dishes properly. Put all silverware together. Put like dishes together, such as dinner plates, saucers, bowls, etc.
 - d. Fill sink with **hot** soapy water.
 - e. Wash dishes in this order: glassware, silverware, dinnerware, pots and pans, and skillets.
 - f. Change dishwater if needed.
 - g. Rinse dishes in **hot** water.
 - h. Dry with a clean towel and put away.
5. Keep large appliances clean inside and out.
6. Floor should be kept clean by frequent mopping.
7. Promptly refrigerate leftovers in clean, covered containers; label and date.
8. Do not let food spoil in the refrigerator.
9. Wipe or wash lids, caps, and the outside of bottles and jars before putting back in the refrigerator.
10. Never taste food that might be spoiled. Throw it away.
11. Keep trash cans clean. Periodically wash with hot soapy water. Rinse, and let air dry.
12. Use plastic or glass cutting boards instead of wooden ones to eliminate danger of bacterial contamination from one food product to another.
13. Do not use food if the can is bulging.
14. Never store food under the sink.
15. Occasionally clean behind the stove and refrigerator. Wipe off cabinet shelves.

Safety in the Food Science Laboratory

General Guidelines

1. Wash your hands prior to any work in the food science laboratory and wash your hands again before leaving the laboratory.
2. Always wear an apron.
3. Wear safety goggles when instructed by your teacher.
4. Read all instructions for each laboratory experience before beginning work in the laboratory. Ask your teacher to clarify procedures if they are unclear or you do not understand them.
5. Use extreme care when mixing any chemical substance; wear gloves to protect your skin from injury.
6. Do not inhale any chemical substance unless instructed to do so in the instructions for the experiment.
7. Handle glass carefully. Hot glass looks just like cold glass. Use a pot holder or insulated mitt when handling hot glass. Use tongs or clamps when handling hot test tubes or beakers.
8. Use a metal trivet or insulating pad when heating glass beakers on the range or cooktop.
9. Never leave a beaker unattended on the range or cooktop. Do not heat an empty beaker. Carefully remove the beaker from the heat source before the contents have boiled away.
10. Do not taste substances in the food science laboratory or lick your fingers unless instructed to do so by your teacher. Taste testing in the food science laboratory follows an organized, scientific procedure to ensure credibility of the results.
11. Know the location of the first aid kit and procedures for using the first aid supplies.
12. Stay in your assigned laboratory group at all times unless instructed differently by your teacher.
13. Be conscientious of the health and safety of your classmates. Disruptive behaviors and inappropriate actions are not permitted in the food science laboratory.

To prevent cuts

1. Use a cutting board when using a knife. Hold food and knife in such a way that you will not cut your finger if the knife slips. Always cut away from yourself.
2. When washing a knife, hold it so the blade is away from the hand that is holding the dish cloth or towel. Always hold onto the knife while it is in the dishwasher.
3. Dry your hands before handling any equipment.
4. Do not store knives loose in a drawer. Use a special compartment, knife holder, or knife rack.
5. Never use a knife as a can opener.
6. Report glass breakage to your teacher. Sweep up all the pieces immediately. Use a damp paper towel to pick up tiny pieces.
7. When loading the dishwasher, do not point knife blades upward. It is better not to put sharp knives in the dishwasher.
8. Use a vegetable peeler instead of a knife for peeling vegetables, such as carrots and potatoes. Push peeler away from you.
9. Keep your fingers away from the beaters in mixers and the blades in other small kitchen appliances.
10. When opening cans, cut the lid completely off.
11. Place a damp cloth under a cutting board to prevent the cutting board from slipping.

Safety In the Food Science Laboratory, Cont'd.**To prevent burns**

1. Keep the lab neat. Take only the papers required for the laboratory experience into the work area.
2. Know the location of the fire extinguishers and the procedure for using them.
3. Do not heat any substance or bring it in contact with a flame unless instructed to do so.
4. Do not leave substances being heated unattended.
5. Never reach across an open flame.
6. Notify your lab partners when igniting a burner in the food science laboratory.
7. Never use an open flame with volatile liquids (i.e., alcohol, etc.).
8. Use tongs or clamps when handling hot test tubes or beakers. Never hold test tubes in your hands while heating.
9. Point pot handles inward but not over another hot burner.
10. When removing a lid from a pan, tilt the lid so that the steam goes away from you.
11. Always use a dry potholder (never a dish towel) to pick up hot objects.
12. When turning meat in the frying pan, hold the lid in front of you as a shield against popping grease.
13. When deep fat frying, have grease at least 4 inches below the top of pan to prevent boil-over.
14. Put out grease fires on the range by putting a lid on the pan, pouring salt or baking soda on the fire, and turning off the range. Do not throw water on a grease fire.
15. Tighten loose pot handles.
16. Do not fill a pan so full that it will boil over.
17. When removing a pan from the oven, pull the oven rack out. Do not reach into a hot oven.
18. Keep flammable materials away from the range and away from portable appliances that get hot. Use a metal trash can when disposing of hot or smoldering items.
19. When lighting gas burners with a match, strike the match first, then turn the burner on.
20. If you smell gas, turn off all range and oven controls and tell your teacher.
21. Carefully remove lids and plastic wrap from microwave dishes to avoid burns from the steam.

To prevent falls

1. Use a stool or step ladder to reach something on a high shelf.
2. Immediately wipe up any liquids spilled on the floor.
3. Close cabinet doors and drawers after opening them.
4. Pick up objects that are dropped on the floor.

To prevent electric shock

1. Plug in and unplug electric appliances with dry hands.
2. Keep electrical cords away from the sink or any wet surface.
3. Unplug the toaster or any small appliance before trying to remove something that is stuck in it.
4. Do not allow electric cords to drape off the countertops.
5. Do not string electric cords across the room.
6. Unplug all portable appliances after use.

Safety in the Food Science Laboratory, Cont'd.

To prevent other types of accidents

1. Keep cabinet doors closed.
2. Always unplug the electric mixer before inserting or removing the beaters.
3. Use a rubber scraper to scrape sides of the bowl when using the electric mixer.
4. Plug the cord of portable appliances into the appliance first, then plug into the wall.
5. Do not heat sealed jars, cans, or bottles in the microwave.
6. Use a potholder to remove food from the microwave.
7. Use your legs and keep your back straight when lifting heavy objects.

STUDENT AGREEMENT

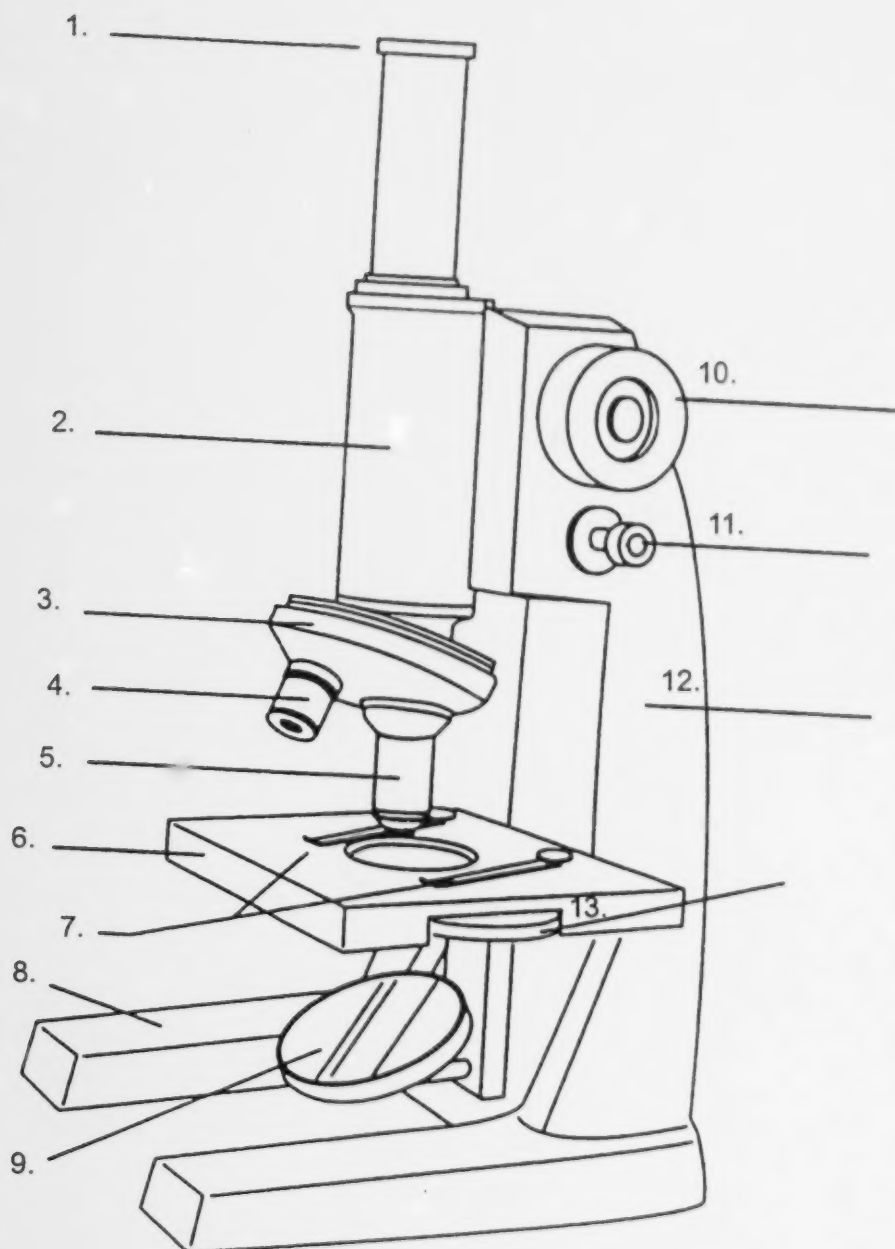
I have read and clearly understand all of the laboratory safety rules. I recognize that it is my responsibility to keep the laboratory work area safe and clean. By signing this form, I agree to the following:

- Read carefully all of the instructions and procedures for each assignment in the food science laboratory.
- Follow the instructions of the teacher for conducting the laboratory experiment.
- Practice all of the rules and procedures for personal hygiene and safety while working in the food science laboratory, including washing my hands before and after each laboratory experience, wearing an apron for all procedures, and wearing safety goggles when instructed by my teacher.
- Learn how to use the fire extinguisher and first aid supplies.
- Behave responsibly while working in the food science laboratory for the safety of myself and others.

Signed: _____ (student)

Date: _____

A Laboratory Microscope



Answer Key for A Laboratory Microscope

1. eyepiece
2. body tube
3. revolving nosepiece
4. low-power objective lens
5. high-power objective lens
6. stage
7. stage clips
8. base
9. mirror
10. course adjustment knob
11. fine adjustment knob
12. arm
13. diaphragm

Basic Food Science Laboratory Equipment and Supplies

▲ Listed below is an overview of equipment and supplies needed for the laboratory experiments suggested in this instructional guide. Detailed lists of specific equipment and supplies needed for individual experiments are given either in the instructional strategies or on the Teaching Aid page for the experiment. Perishable items needed for the experiments are listed with the instructions for the experiment.

Note: Any experiments using chemicals require the use of safety goggles and gloves. Please read the information provided on TA 4, **Safety in the Food Science Laboratory**, and other reference information on safety in the science laboratory.

The list below indicates equipment needed for one laboratory station (one kitchen area).

- microscope
 - test tubes (4)
 - test tube rack
 - beakers or graduated cylinders
 - eye dropper
 - ruler
 - wooden skewers
 - cotton swabs
 - resealable plastic sandwich bags
 - iodine
 - 3% hydrogen peroxide
-
- clear drinking glasses (4-6)
 - cutting board
 - standard kitchen tools and utensils (i.e., measuring equipment, knives, wooden spoons, mixing bowls, etc.)
 - kitchen timer
 - grater
 - assorted microwave cookware
 - assorted bakeware (baking sheet, loaf pan, muffin pan, tube pan)
 - flatware for taste testing
 - assorted stovetop cookware
 - range or cooktop and oven
 - microwave oven
 - electric mixer
 - pressure cooker

The Scientific Method for Food Science Experiments

Question.

1. Identify the problem. State it clearly as a question.

Research.

2. Gather information. Record notes from information gathered on the back of this form.

Hypothesis.

3. Form a hypothesis based on information gathered.

Procedure.

4. Test the hypothesis through experiment and/or observation. (List steps you will follow to test the hypothesis.)

Conclusions.

5. Draw conclusions based on the results.

Laboratory Plan of Work

Date: _____
Laboratory Experience: _____
Laboratory Group Number: _____

Equipment Needed	Grocery Supplies Needed (List exact amounts)

Time Schedule

Laboratory Assessment: Food Products

(to be completed by each student)

Standards for Food Product Evaluation

Score	Standard (Determined by student)
_____	1. _____
_____	2. _____
_____	3. _____
_____	4. _____
_____	5. _____

Rubric for Laboratory Experience

▲ Evaluate your food product using the standards above. Include standards for flavor, color, shape, texture, and temperature. Use a rating scale from 3 to 1 with 3 as excellent and 1 as undesirable, placing the score in the left-hand column marked *Score*.

3	2	1
_____ Demonstrated good organizational skills; gathered supplies and equipment at one time; used dovetailing to accomplish tasks efficiently	Demonstrated average organizational skills; several steps taken to gather supplies and equipment; used some dovetailing to accomplish tasks	Demonstrated below-average organizational skills; gathered supplies and equipment one at a time; did not use dovetailing techniques
_____ Followed all cooking principles related to designated product	Inconsistently followed cooking principles related to designated product	Did not follow cooking principles related to designated product
_____ Demonstrated proper measuring techniques at all times	Demonstrated proper measuring techniques but not consistently	Did not demonstrate proper measuring techniques
_____ Demonstrated proper knife/safety skills	Demonstrated proper knife/safety skills but not consistently	Did not demonstrate knowledge of proper knife/safety
_____ Equipment/supplies returned to proper location; lab area cleaned to teacher specifications	Returned some equipment/supplies to proper location; cleanliness of lab area needs improvement	Equipment and supplies not returned to proper location; lab area left unclean

Reflection

▲ On the back of this sheet, list three changes you could make in your lab procedure to improve the product.

Laboratory Report: Food Science Experiments

Title of Experiment: _____

Names of lab group members: _____

Date: _____

Class Period: _____

1. Problem/Purpose of Experiment:

2. Hypothesis:

3. Procedure:

4. Observations:

5. Data: Attach completed data table to this report (if a data table was used).

6. Safety procedures: Record safety procedures followed during this experiment.

7. Conclusions:

Nutrient Groups



- Vitamins

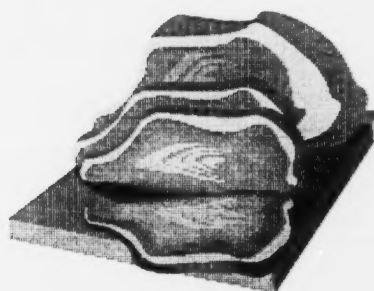
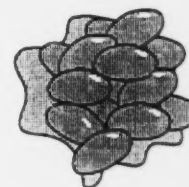
- Minerals

- Proteins

- Fats

- Carbohydrates

- Water



The Nutrients

Directions: Fill in the information for each nutrient given in the group presentations.

Nutrient	Function in the body	Sources
Protein		
Carbohydrates		
Vitamin A		
Vitamin D		
Vitamin E		
Vitamin K		
Provitamin Beta carotene		
Riboflavin		
Thiamin		
Niacin		
Vitamin B ₆		
Vitamin B ₁₂		
Vitamin C		
folate		
biotin		

The Nutrients, Cont'd.

Nutrient	Function in the body	Sources
pantothenic acid		
calcium		
phosphorus		
magnesium		
sodium		
chloride		
potassium		
iron		
zinc		
copper		
selenium		
iodine		
fluoride		
fats		
water		

Nutrient Terms

protein

amino acid

saturated fat

polyunsaturated fat

monounsaturated
fat

fat-soluble
vitamins

water soluble
vitamins

water

carbohydrates

cholesterol

vitamin A

vitamin C

riboflavin

thiamin

niacin

vitamin D

vitamin E

vitamin K

iron

calcium

iodine

phosphorus

folate

vitamin B₁₂

beta carotene

sodium

potassium

"Jeopardy" Game Instructions

1. Use questions and answers written on index cards (answer on the front, question on the back) as subject matter for the "Jeopardy" game.
2. Divide index cards into three stacks. Assign cards in each stack 10 points, 20 points, and 30 points, respectively. Write the point value on the front of the card (along with the answer).
3. Form teams of 3-4 students, and give each team a colored "responder" card.
4. Have each team select a team captain and team scorekeeper.
5. The teacher reads aloud the answer from a card. The team captain who holds up the responder card first has the first opportunity to answer.
6. All team responses must be given in the form of a question. For example, you say, "providing their children proper nutrition." The correct student response would be something like, "What is a responsibility parents have related to the physical development of their children?"
7. If the first team to respond gives the correct answer, they receive the point value for that item. If they answer incorrectly, then the point value is subtracted from their score and another team is given the opportunity to answer.
8. The team captain must confer with the team members before responding with a question.
9. The team captains hold up the "responder" card when their team is ready to respond. Only the team captain can hold up the responder card.
10. The team scorekeeper is responsible for keeping the correct score for the team. The scorekeeper should be included in determining the correct responses.
11. The team with the highest score is the winner.



Diet-related Diseases and Disorders

Anorexia nervosa — Eating disorder where 15 percent loss or more of original body weight occurs. Person has an intense fear of gaining weight or becoming fat even when underweight. Person has a distorted body image.

Bulimia nervosa — Eating disorder where there are recurrent episodes of binge eating followed by self-induced vomiting. Person feels a sense of a lack of control over eating behaviors and uses laxatives and diuretics. Obsession with body shape, image, exercising, strict dieting, and/or fasting.

Cancer — Research has shown a strong link to diet and cancer. The phrase "everything in moderation" can help battle the changes of getting many types of cancer. Decreasing fat consumption, eating more vegetables, fruit, and whole grains, avoiding heavily smoked and salt cured foods, increasing daily intake of fiber-rich foods, and avoiding alcohol consumption are healthy practices shown to reduce the risk of certain types of cancer.

Cardiovascular Disease — Cardiovascular disease is America's number one killer in men and women. Cardiovascular disease includes conditions such as heart attacks, stroke, high blood pressure, angina (chest pain), poor circulation, and abnormal heartbeats. Cardiovascular disease is linked to high total blood cholesterol levels. Prevention includes reducing intake of foods with unsaturated fats, eating a low cholesterol diet with increased fiber, fruits, and vegetables intake maintaining or improving body weight, exercising, and reducing stress.

Diabetes — This is a genetic disorder and is not caused by eating too much sugar. Diabetes occurs in people whose pancreas does not produce enough insulin to control blood sugar levels. Diabetics must control their intake of carbohydrates in order to maintain normal blood sugar levels. Diabetics can control their blood sugar levels by diet and medication.

Food Allergies — Often inherited and usually diagnosed in childhood, children are more likely to have food allergies than adults. True food allergies cause changes in the body's immune system even though the person is not sick. When individuals eat food they are allergic to, their bodies scramble for protection by making antibodies. The most common food causing allergic reactions include eggs, milk, soy, wheat, shellfish, and peanuts.

Food Intolerances — With a food intolerance, physical reactions to a food often result from faulty metabolism. The body cannot adequately digest a certain component of a particular food. Elements of a food's natural chemistry may cause reactions. Common intolerances are lactose (milk), gluten (protein in grains), and sulfites (prevents browning and slows growth of bacteria).

Hypertension — Hypertension, or high blood pressure, means that the heart must work much harder to pump the blood. Sustained high blood pressure puts individuals at great risk for stroke, heart attack, or kidney failure.

Diet-related Diseases and Disorders, Cont'd.

Obesity — Men having over 25 percent body fat and women having over 30 percent body fat are considered obese. Target percentages of body fat are 15 - 18 percent for men and 20 - 25 percent for women. Many health risks can develop in obese people. Developing lifelong habits of healthy eating and exercise are ways to prevent obesity.

Osteoporosis — Osteoporosis is a condition of gradually weakening, brittle bones. The signs do not appear until age sixty or so, but keeping bones healthy is a lifelong process. From adolescence on, eating and lifestyle habits can protect individuals from this debilitating disease in later life. Consuming the RDA for calcium and vitamin D combined with weight bearing activity are the best ways to prevent this bone condition. There is no cure, but medical treatment is available.

Dietary Guidelines for Americans

Aim for Fitness. . .

- ▲ Aim for a healthy weight.
- ▲ Be physically active each day.



Build a Healthy Base. . .

- Let the Pyramid guide your food choices.
- Choose a variety of grains daily, especially whole grains.
- Choose a variety of fruits and vegetables daily.
- Keep food safe to eat.

Choose Sensibly. . .

- Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.
- Choose beverages and foods to moderate your intake of sugars.
- Choose and prepare foods with less salt.
- If you drink alcoholic beverages, do so in moderation.

Source: "Dietary Guidelines for Americans," 2000, 5th edition. USDA

⇒ Figure 14.3

Food Guide Pyramid

A guide to daily
food choices

Key



Fat (naturally
occurring
and added)



Sugars (added)

Fats, oils, and sweets

Use Sparingly

Milk, yogurt,
and cheese

2 - 3 servings

Meat, poultry, fish,
dry beans, eggs,
and nuts

2 - 3 servings

Vegetables

3 - 5 servings

Fruit

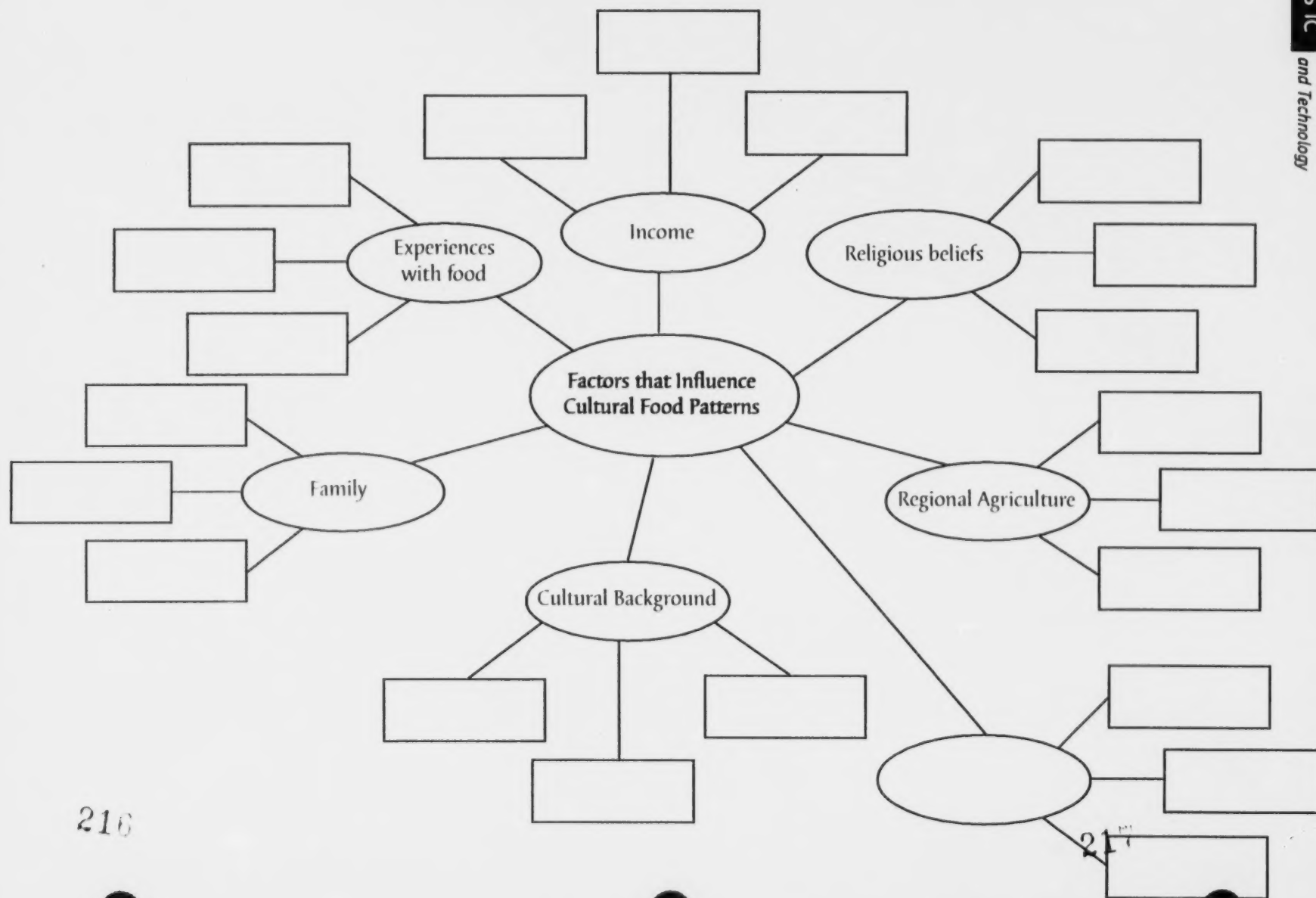
2 - 4 servings

6 - 11 servings

Grains: Bread, cereal, rice, and pasta

Adapted from: "The Food Guide Pyramid," Home and Garden Bulletin No. 252, United States Department of Agriculture Human Nutrition Information Service.

Factors That Influence Cultural Food Patterns



CULTURAL FOOD PATTERNS

Cultural group: _____

Common Foods:

Bread, rice, cereal, pasta

Fruits

Vegetables

Meat, poultry, eggs, nuts, legumes, fish

Milk, yogurt, cheese

Sweets

CULTURAL FOOD PATTERNS, CONT'D.

Common Foods:

Dietary mainstays of the culture
Daily eating patterns
Special occasion foods
Role and importance of food in this culture

Cultural Foods

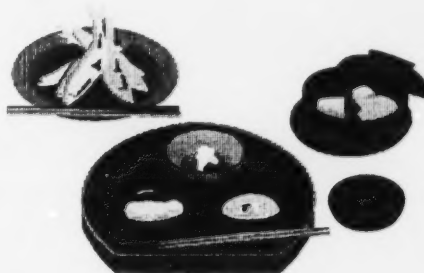
◆ Display for the class a variety of cultural foods from the list below or others that you select. Number each food on a 3x5 index card with the name of the food, country of origin, and information of its use or preparation on the back. After students have tried to identify the foods and country of origin, use this additional information in a class discussion on these cultural foods.

1. **Mango** (India) - a fruit with a sweet aroma is eaten raw or cooked. In India, mangoes are the main ingredient of chutney; in Thailand mangoes are pureed and dried to form a popular paste used in Thai cooking. Mangoes should be eaten peeled as the peeling can irritate the mouth. Mangoes are an excellent source of vitamin A, vitamin C, and potassium.
2. **Tofu** (China) - the curd made from the milky liquid extracted from soybeans. It is not a dairy product. Tofu is an excellent source of protein with much less fat than its meat equivalents. Tofu is very versatile and can be used as a meat substitute in many recipes, as well as in soups, dips, main dishes, and ice cream.
3. **Couscous** (Algeria, Morocco, Tunisia) - a grain product made by mixing semolina with flour and adding cold, salted water; the dough-like mixture is then pressed or rolled to make tiny beads. Couscous is used like rice or other grains and can be added to soups, salads, or desserts.
4. **Artichoke** (Mediterranean countries) - a vegetable served cooked or used in salads and appetizers. Only the heart of the bud and the base of the leaves are edible. Artichokes are an excellent source of potassium, magnesium, and folic acid.
5. **Tomatillo** (Mexico) - a fruit (actually a berry) that is picked when green and becomes yellow or purple when ripe. Tomatillos are used extensively in Mexican cooking. Tomatillos are an excellent source of potassium, vitamin C, magnesium, niacin, and thiamin.
6. **Quinoa** (Bolivia, Chile, Peru) - a seed-like cereal substituted for cereal products, especially rice. Ground quinoa is used in breads, pasta, baked goods, and puddings. Quinoa is an excellent source of magnesium, iron, and potassium. It is most often found in health food stores.
7. **Rutabaga** (Scandinavian countries) - a vegetable that is a cross between a cabbage and a turnip. It was developed during the Middle Ages. The rutabaga can be eaten raw or cooked and often is used in soups and stews. Rutabagas are an excellent source of potassium and vitamin C.
8. **Plantain** (Malaysia, Africa, West Indies) - a fruit of the banana tree and often called the "cooking banana." It is a staple food in its native regions of the world. It is used as a vegetable with a flavor similar to the sweet potato. It is an excellent source of potassium, vitamin C, vitamin B₆, and magnesium.

Cultural Food Choices: What Is the Nutritional Value?

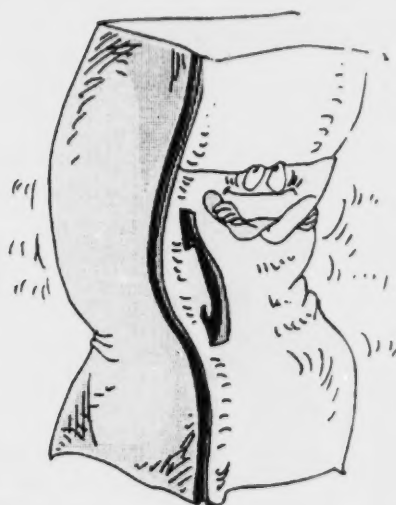
▲ The following are samples of some cultural foods of the native countries.

- Scottish foods: mince (ground meat); tatties (potatoes); fish; oats.
- British foods: roast beef; Yorkshire pudding; steak and kidney pie; bacon; sausage eggs; grilled tomatoes; bread.
- Vietnamese foods: rice; thit kho (pork cooked in fish broth); rau luoc (boiled vegetables); canh ca (fish and vegetable soup); watermelon; papaya; bananas; citrus fruits.
- Nigerian foods: yams; cassava; rice.
- Chinese foods: rice; potatoes; duck; wheat pancakes; tofu.
- Colombian foods: arroz con pollo (chicken with rice); frijoles con chicharon (beans with pork); sancocho (stew with fish or meat and vegetables); arepa (cornmeal pancake); changua (potato and egg soup).
- Japanese foods: miso (bean paste soup); ramen, udon, and soba (noodles); curried rice; sashimi (fish); tofu; pork.
- Filipino foods: rice; fish; fruit; adobo (chicken and pork in garlic, soy sauce, and vinegar); kare-kare (stew of meats and vegetables in peanut sauce).
- Guatemalan foods: tamalitos (cornmeal dough wrapped in corn husks and steamed); black beans; rice; tamales; greens; fried plantanos (bananas); papaya; breadfruit.
- Indian foods: rice; roti (wheat bread); onions; nuts; eggs; fish.



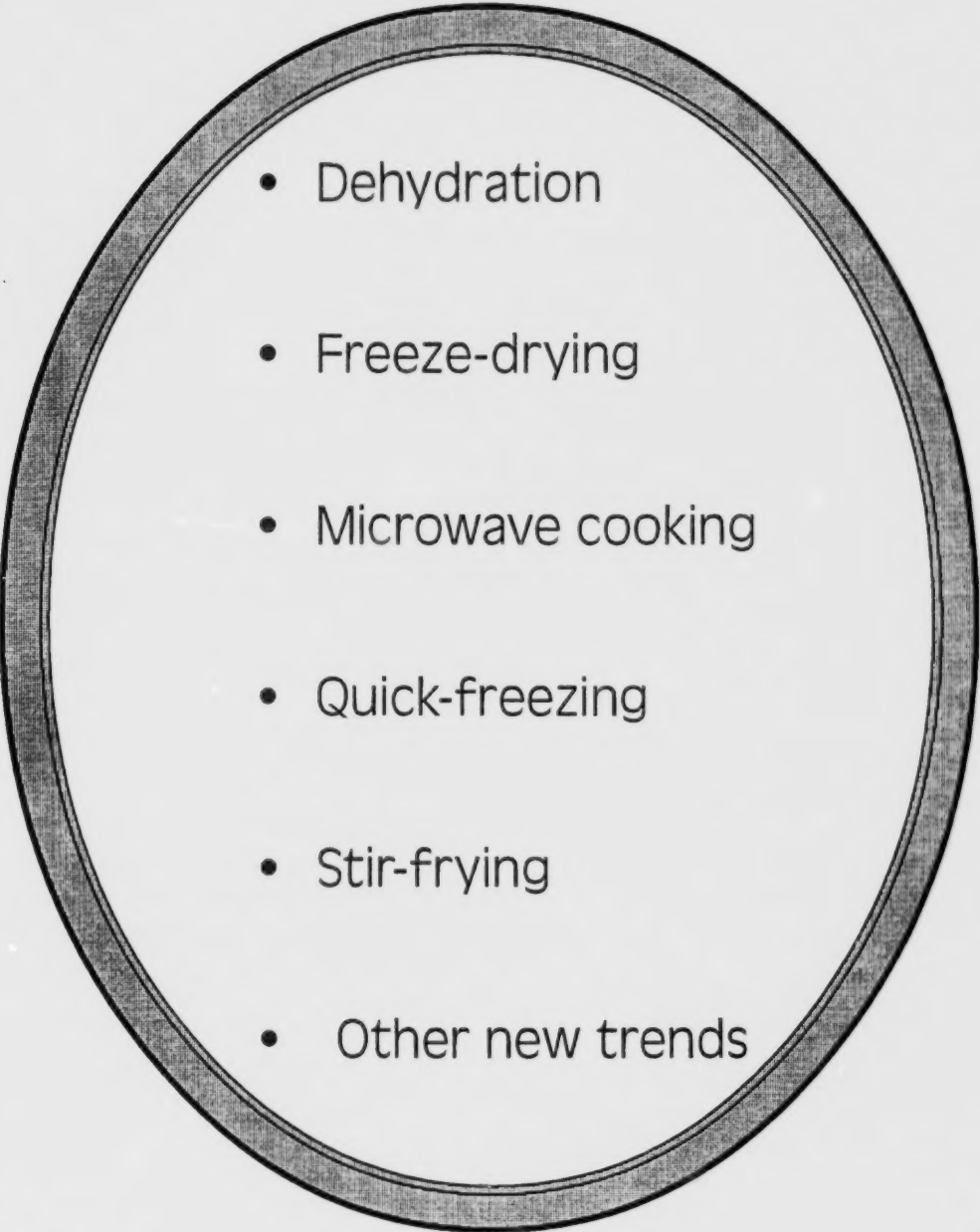
Preserving Nutrients

- ⇒ Avoid overcooking. Prolonged exposure to heat causes loss of some vitamins.
- ⇒ Cover refrigerated foods with tight-fitting lids, foil, or plastic wrap.
- ⇒ Cut fruits and vegetables in large pieces. Chop immediately before use to avoid unnecessary exposure to oxygen.
- ⇒ Freeze or refrigerate leftovers immediately after use. Leaving foods exposed to room temperature increases nutrient loss, promotes an environment for bacteria to grow, and increases rate of spoilage.
- ⇒ Include raw fruits and vegetables in menu planning and food preparation.
- ⇒ Refrigerate most products to reduce nutrient loss.
- ⇒ Rinse foods in cold water. Do not soak. This causes loss of valuable water-soluble nutrients.



- ⇒ Thaw frozen foods in the refrigerator. More nutrients are retained at cooler temperatures, and this also inhibits the growth of organisms that can cause foodborne illness.

Technology and Trends in Nutrient Retention

- 
- Dehydration
 - Freeze-drying
 - Microwave cooking
 - Quick-freezing
 - Stir-frying
 - Other new trends

Technology and Trends in Nutrient Retention Worksheet

Directions: Record descriptive information presented in class on each of the following food preparation and food processing methods.

Dehydration	
Freeze-drying	
Microwave cooking	
Quick-freezing	
Stir-frying	
Other new trends	

Terms to Know

- Nutrification
- Enrichment
- Fortification
- Restoration

Improving the Nutrient Content of Foods

- Use long or short-grain brown rice in place of white rice to improve fiber content.



- Use whole-grain flours, such as whole-wheat flour, in place of white flour for yeast breads and quick breads. Whole-grain flours are high in fiber and B vitamins.
- Add legumes to soups, stews, casseroles, and salads to increase fiber and protein intake; legumes are excellent sources of B vitamins, iron, and calcium.
- Substitute polyunsaturated vegetable oils, such as canola, safflower, olive, sunflower, and corn in place of saturated oils (palm and coconut), shortening, and lard.
- Save the water from cooking vegetables to add to soups and stews. Many water-soluble nutrients are leached into the cooking water.
- Cook vegetables with the skins and peelings on to preserve nutrients.
- Substitute puréed nonfat cottage cheese, nonfat yogurt, or nonfat sour cream in recipes calling for ricotta cheese or sour cream.
- Replace some of the flour in muffin recipes with oat bran to increase fiber and B vitamins.
- Substitute nonfat dry milk for whole milk in recipes to reduce the fat content.
- Substitute canned fruits packed in water for fruit packed in syrup to reduce the calorie content.
- Add raisins to muffins or breads to increase fiber.

Symposium: The Impact of Technology on Food Science

▲ Research and read information from reliable food science sources, including print media and the Internet, on topics related to the impact of technology on food science. Use the computer search in the library to locate articles on the topic you choose.

Suggested topics include the following:

- aquaculture
- dehydrated foods
- fat replacers
- food biotechnology
- food fabrication
- freeze-dried foods
- functional foods
- genetically-engineered foods
- hydroponics
- irradiated foods
- retort pouches

Check with your teacher if you wish to investigate a topic that is not listed.

Resources: Internet, print, and electronic encyclopedias, periodicals, books

Written Assignment: After researching information on your topic, write a two-page summary of the information learned from your reading. If available, use computer word processing programs to write your summary. Include the bibliographical data on a separate sheet of paper that you attach to your summary.

Supermarket Scavenger Hunt

Directions: Find examples of each of the following foods in the supermarket. Write the name of the product and the manufacturer in the space provided below. Complete Part II by listing any food products that reflect new technologies in the food industry.

1. Dehydrated foods

2. Freeze-dried foods

3. IQF (individually quick-frozen foods)

4. Hydroponically-grown foods

5. Genetically-engineered foods

6. Retort pouches

Part II: List below any individual food products that you found that reflect new technologies in the food industry.

Sensory Evaluation of Food Products

◆ Sensory evaluation of food is an important part of food science because sensory tests reveal how a food looks, smells, tastes, and feels. Sensory evaluation of food is a scientific test that is dependent on the human sensory responses to sight, smell, taste, touch, and sound. The characteristics of the food to be evaluated by each of the senses are as follows:

- Sight — appearance of the food
- Smell — odor of the food
- Taste — flavor(s) of the food
- Touch — feel of the food in the mouth
- Sound — sound of the food when biting or chewing

Because human judgement of food is affected by background, past experiences with food, culture, sex, age, health, time of day food is tested, and many other factors, persons performing sensory evaluation of foods should be educated on the characteristics of the foods being studied and whether they are comparing the quality of the samples or comparing the samples to one another. In sensory evaluation, the samples are given random three-digit numbers rather than names.

A **Data Table** is used to record results of the sensory evaluation. A Data Table must be created for each evaluation based on the type of sensory evaluation and the results you need. A sample Data Table for sensory evaluation of three brands of strawberry yogurt is shown as an example.

Sample Data Table				
Yogurt	Color	Odor	Taste	Texture
217	dark pink	fruity	very sweet	smooth
611	peach	none	sweet w/ aftertaste	grainy
125	light pink	strawberry	bitter	grainy
331	light pink	none	sweet w/bitter aftertaste	smooth and very creamy

TERMS USED IN EVALUATING FOOD PRODUCTS

<u>Appearance</u> – visible characteristics broken rough cloudy scum clear sediment crumbly shiny curdled shriveled dull shruken frothy smooth greasy sparkling lustrous stringy muddy translucent opaque plump		<u>Color</u> – pleasing to the eye, normal for the product bright golden brown creamy normal discolored off-color dull pale faded rich gray snowy white greenish yellow		<u>Shape</u> – proportionate dimensions of food broken oval even round flat thick square thin irregular uneven	
<u>Size</u> irregular large medium small uniform	<u>Lightness</u> – large volume in relation to weight, not dense fluffy light in weight for size porous	<u>Consistency</u> – firmness, density, viscosity, plasticity brittle syrupy crisp soft crumbly soggy curdled stiff firm thick frothy thin gummy hard liquid mealy rubbery runny		<u>Grain</u> – structural quality, such as size of crystals or cells and thickness of cell walls, in cake and bread amorphous coarse crystalline fine foamy grainy granular heavy porous	

TERMS USED IN EVALUATING FOOD PRODUCTS, CONT'D.

<u>Texture</u> – feel of substance between fingers or in mouth brittle oily chewy pasty fibrous rubbery firm slimy grainy smooth granular soggy limp sugary lumpy stringy mealy mushy	<u>Tenderness</u> – ease with which food can be cut, broken, or chewed fibrous stringy tender tough	<u>Moistness</u> – degree of moisture dry juicy moist watery succulent
<u>Taste</u> salty sweet sour bitter	<u>Aroma</u> – volatile substances which affect the sense of smell acid acid burnt delicate earthy floral fragrant medicinal moldy putrid rancid	<u>Flavor</u> – combination of taste and smell (or aroma) astringent stale bland starchy blended stimulating brisk strong burned tasteless delicate flat full-bodied pungent raw rich scorched

Adapted from: *Experimental Methods with Food Laboratory Manual* by Helen C. Brittin. (1993) Texas Tech University.

The Scientific Method of Investigation

- 1) Identify the problem and state it clearly as a question.
- 2) Gather information by such means as reading, interviewing, observing, and surveying.
- 3) Form a hypothesis, or possible answer to the problem, based on information gathered through research or observation.
- 4) Test the hypothesis through experiments or carefully recorded and classified observations.
- 5) Draw conclusions based on results.



Scientific Problem Solving

▲ The scientific method is a means of solving problems scientifically; it is a methodical process of controlling and manipulating variables while adhering to scientific standards of attitude and behavior. However, actual steps in the scientific methods may vary. Generally, the scientific method includes the following steps:

- 1) Identify the problem and state it clearly as a question.
- 2) Gather information by such means as reading, interviewing, observing, and surveying.
- 3) Form a hypothesis, or possible answer to the problem, based on information gathered through research or observation.
- 4) Test the hypothesis through experiments or carefully recorded and classified observations.
- 5) Draw conclusions based on results.

Observations are an effective means of gathering information. Observations should be accurate, precise, and recorded in an organized format. The use of information, such as microscopes, rulers, cameras, or magnifying glasses, can increase the accuracy of sensory observations. Interpretations are conclusions that are based on observations. The validity of interpretations is increased when the interpretations are supported by multiple observations.

Attitudes central to research and scientific inquiry include honesty, objectivity, openness, skepticism, questioning, accuracy, carefulness, and unbiased evaluation. Regardless of the selected project focus, it is important to recognize and understand the importance of these attitudes to the success of any investigative study.

A Scientific Study

Scientists observed that white mice that had all milk group foods eliminated from their diets exhibited a number of physical effects as a result of omitting the nutrients found in these foods from their diet. These physical effects included loss of hair, red eyes, dry and flaky skin, stunted growth of body and tail, and reduced energy. The study was conducted with one hundred white mice. Fifty mice were fed balanced diets using the Food Guide Pyramid as a guide. The other fifty mice were fed the same diet with the exception of the omission of foods from the milk group. The mice were kept on this experimental diet for four weeks. At the end of the four weeks, all one hundred of the mice were fed the same balanced diet. Although most of the physical effects diminished, the mice given the experimental diet never grew to comparable body size as the group fed the balanced diet.

Directions: Use the information provided above to answer the following questions.

1. Which group of mice were in the control group?
2. What was the variable being tested?
3. What likely was the hypothesis for this experiment?

Scientific Problem Solving, Cont'd.

4. How was the hypothesis tested?
5. What type of information would you have recorded from your observations of the mice?
6. What conclusions would you draw from this experiment?

Methods for Recording and Organizing Information and Compiling Findings

◆ There are many ways in which you may choose to compile findings from an experiment or scientific study. However, it is extremely important that your findings be organized so that they may be interpreted by you and understood by others. Some methods for compiling and organizing findings include the use of charts, tables, graphs, diagrams, and outlines. Graphic organizers, such as charts, tables, diagrams, and graphs, help to visually organize data for evaluation and to recognize relationships. Textual charts and outlines present a detailed summary or condensed version of research information related to a specific topic, plan of action, or the steps involved in accomplishing a task or set of tasks.

It is best to examine some examples of these tools to help you determine which method is best for you to use. You may decide that using more than one method (such as recording results of the experiment in a table and then plotting the results on a graph to show the relationships or differences) will best help you interpret the results of your experiment or scientific study.

The following descriptions may help you determine which methods will be best to use for recording and reporting results of experiments conducted in the Food Science and Technology course.

- Charts — used to detail steps in a procedure, to show rank order, to list explanation of terms, etc.
- Diagrams — used to show comparisons, relationships, or for deductive reasoning
- Graphs — used to show the relationship of a variable to one or more other variables, etc.
- Outlines — used to summarize detailed information on a topic, describe a plan of action, etc.
- Tables — a systematic arrangement of data in rows and columns used to record information collected during scientific experiments or studies

Data Table

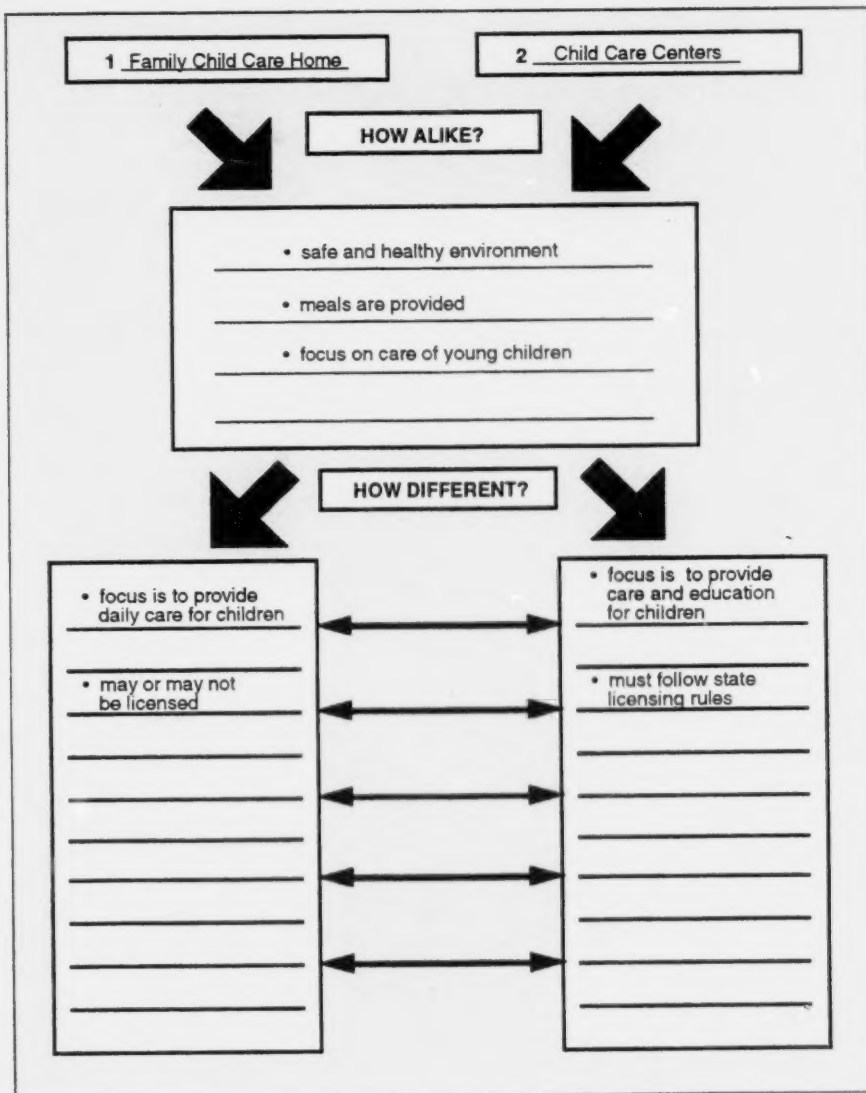
Sensory Comparison of Four Brands of Yogurt				
Yogurt	Color	Odor	Taste	Texture
217	dark pink	fruity	very sweet	smooth
611	peach	none	sweet w/ aftertaste	grainy
125	light pink	strawberry	bitter	grainy
331	light pink	none	sweet w/bitter aftertaste	smooth and very creamy

Matrix Diagram

Characteristics of Some Cultural Groups in Texas

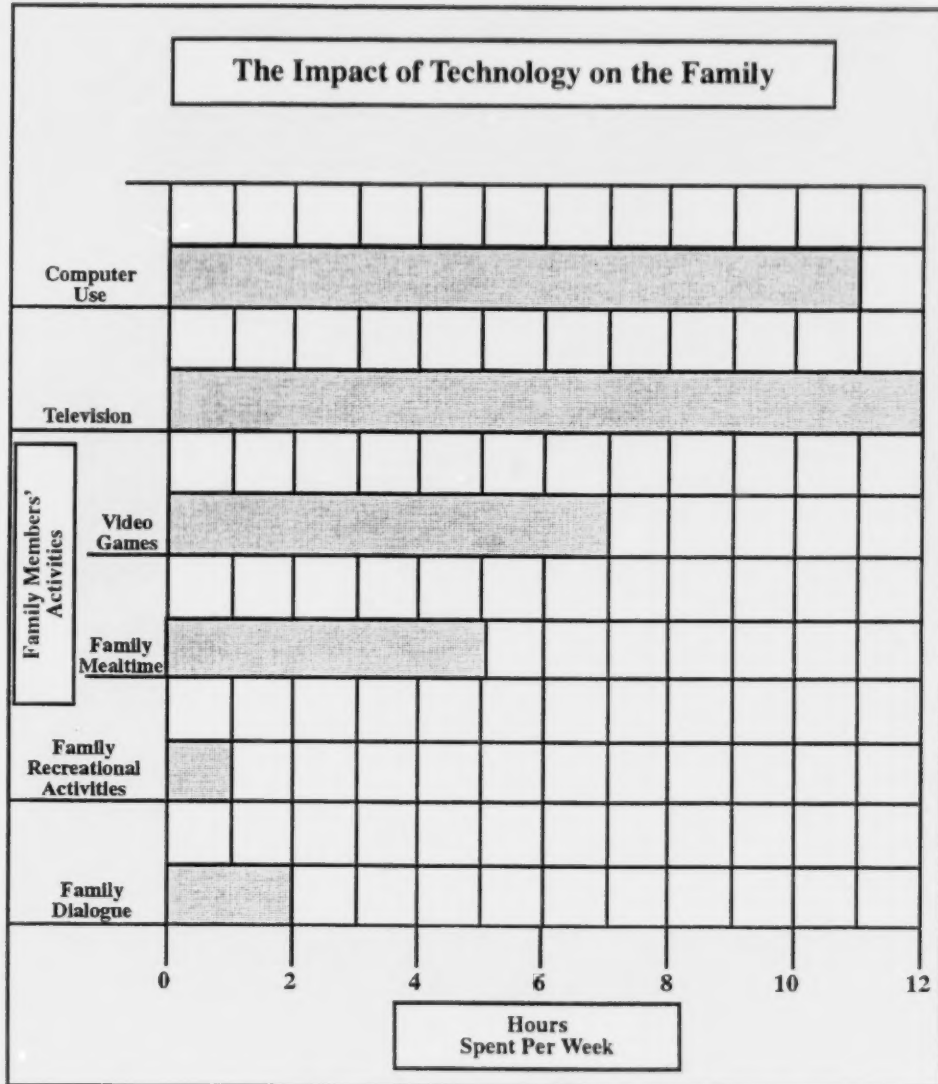
	German	Mexican	Norwegian	Polish	Vietnamese
Traditional Foods	Pork Cabbage Spätzle (dumplings)	Carne Guisada Menudo Tortillas	Fish Lamb Rice Pudding	Sauerkraut Pierogi (dumplings) Potato Pancakes	Shrimp Rice Noodles Nuoc mam (fish sauce)
Native Language					
Family Traditions					
Special Holiday Celebrations					

Compare and Contrast Diagram



Adapted from: *Organizing Thinking*, Midwest Publications, 1990.

Bar Graph



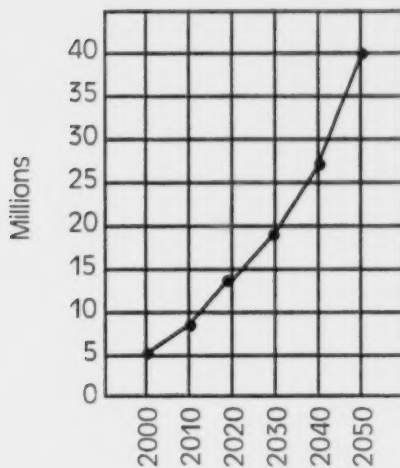
Adapted from: *Organizing Thinking*, Midwest Publications, 1990.

BEST COPY AVAILABLE

Line Graph

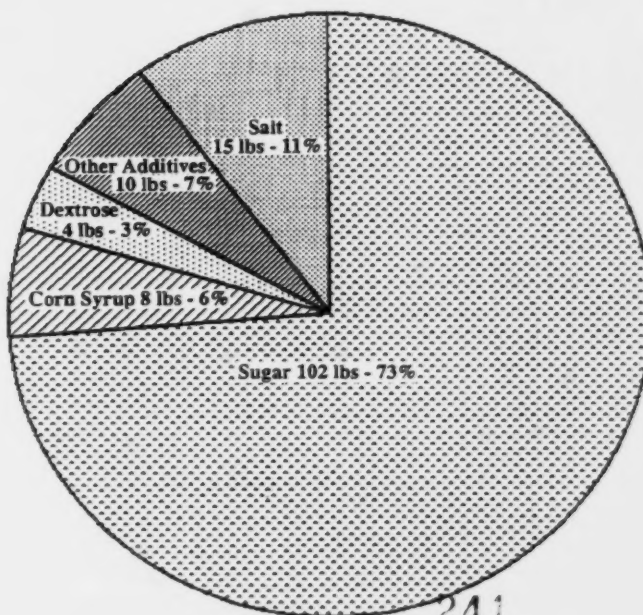
Projected Population 85 Years and Older

2000-2050

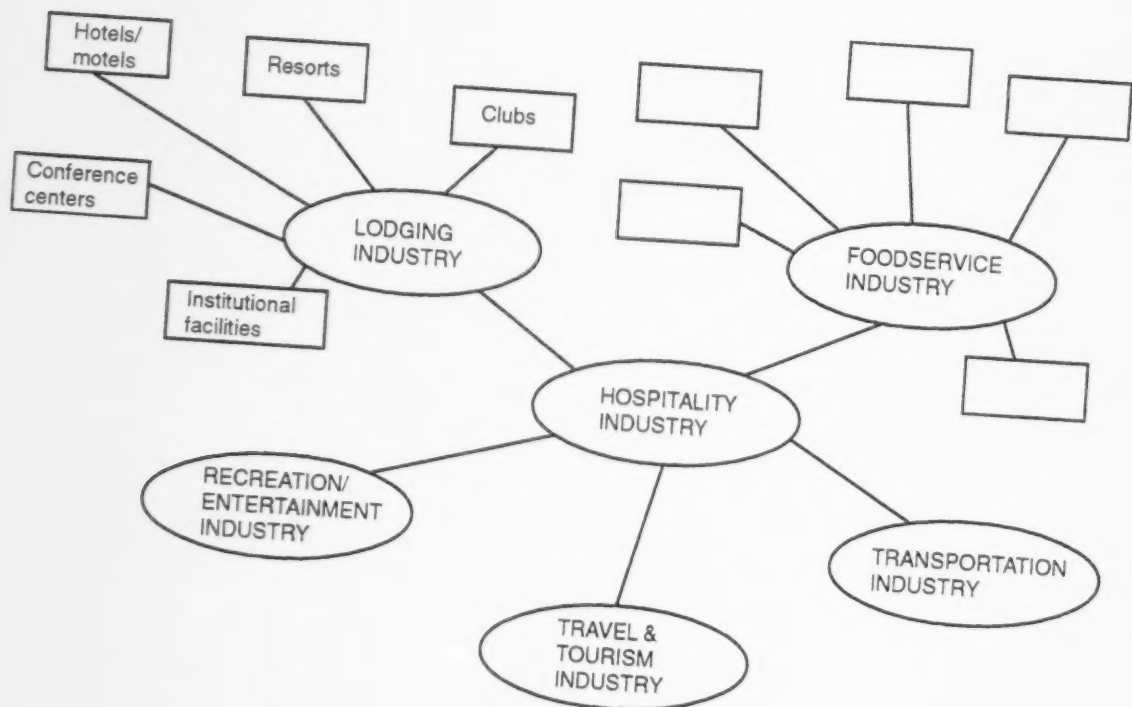


Pie Graph

Percentages of Annual Additive Intakes



Web Diagram



Which Method to Use?

Directions: Draw a representative chart, diagram, graph, or table that would be appropriate to use with each of the experiments below. Although you do not have data to record, you can show how you would set up the chart, diagram, graph, or table to organize and interpret your findings. By thinking carefully about the procedures you would use, you will be able to determine which method will best suit each experiment.

- 1) Determine the effect of temperature on the ripening of fruit.
- 2) Determine the effect of preservatives on the freshness and safety of baked products.
- 3) Determine the effect of leavening agents on the volume of yeast breads and quick breads.
- 4) Determine the technological advancements affecting the food service industry in the last twenty years.

Liquid Iron

➤ The main job of iron in the body is to produce hemoglobin in the red blood cells. The hemoglobin carries oxygen from the lungs to all the cells in the body. If the diet has too little iron, then the blood cannot move the oxygen and a disease called anemia results. Persons suffering from anemia are extremely fatigued and listless during their waking hours.

Major sources of iron are red meats, egg yolks, dried legumes, leafy green vegetables, and enriched breads and cereals. Some fruit juices contain iron, although they are not considered a major source of iron. Vitamin C foods, such as citrus fruits and juices, enhance the absorption of iron in the body.

➤ The following investigation is a simple test for the presence of iron.

Materials:

- Fruit juices, such as apple, orange, lemon, grapefruit, pineapple, cranberry, prune, and grape
- Tea bags
- Glasses (one for each liquid)

Procedure:

1. Pour one inch of juice into a glass.
2. Prepare two cups of strong tea and pour 1 inch of it into each glass containing a different juice.*
3. The tannic acid in the tea will combine with the iron in the juice, and the mixture will become cloudy.
4. Develop charts, tables, graphs, or diagrams to record the data from your observations and present the results in a format others can understand.
5. Record the data from your observations and draw conclusions.

* To prepare strong tea, place 4 teabags in 2 cups of boiling water and steep for five minutes.

Key Questions:

- Which juices contained the most detectable iron?
- Which juices contained no detectable iron?
- Which juice contained the most iron?

What is Food Processing?

Food processing includes all methods of preparing food so that it is readily available to be used by the consumer. **Food processing** includes the washing, trimming, and sorting of fresh produce and the highly efficient methods of food preservation used by the food industry today. It is **food processing** that enables cattle, wheat, and sugar cane to become steak, milk, flour, and sugar. Advancements in **food processing** in the United States have allowed consumers to have access to the broadest selection of food items in the world while using the lowest percentage of income than any other country in the world.

Food processing methods involve two areas. One area is the methods involved in food preservation. The second area involves methods of food preparation that make the food suitable for use.



Preservation Methods Used in Food Processing

- Additives/Chemical preservation
 - Aseptic packaging
 - Canning
 - Cold storage
 - Curing
 - Drying/Dehydration
 - Fermentation
 - Freezing
 - Irradiation
 - Modified atmosphere
 - Pasteurization
-

Preparation Methods Used in Food Processing

- Enzyme technology
- Physical modification
- Separation
- Thermal modification

Food Processing Terms

Directions: Use reference materials and information from class discussions to briefly explain the following terms related to food processing.

— **Methods Used in Food Preservation** —

1. Additives/Chemical preservation methods
2. Aseptic packaging
3. Canning
4. Cold storage
5. Curing
6. Drying/Dehydration
7. Fermentation
8. Freezing

Food Processing Terms, Cont'd.

- 9. Irradiation
- 10. Modified atmosphere
- 11. Pasteurization

— **Methods of Preparation That Make Food Suitable for Use** —

- 1. Enzyme technology
- 2. Physical modification
- 3. Separation
- 4. Thermal modification

Chemical Reactions That Occur During Food Processing

➡ All foods are made of chemicals. Some chemicals occur naturally in foods from plants and animals. Other chemicals have been duplicated in laboratories and are known as synthetic chemicals. When food is processed, regardless of the method used, chemical reactions take place. These are desired chemical reactions because they bring about the desired change in the food product that improves the quality of the product or retards spoilage. These chemical reactions perform the following functions:

- Destroy or prevent the growth of harmful or destructive microbes
- Eliminate or control toxins
- Maintain nutritional quality
- Maintain desirable odors and textures
- Increase shelf life of foods

Factors That Influence Chemical Reactions in Food

Factor	Chemical Reaction
Acidity	The presence of acid in food lowers the pH level. The acid inhibits microbial growth.
Nutrients	In some foods, nutrients may be bound to other chemical compounds. This makes them unavailable for use by the body.
Oxygen	Oxygen is the principal factor needed for the growth of most living organisms. The absence of oxygen in some preservation methods inhibits the growth of microorganisms.
Temperature	Most microorganisms experience optimum growth at temperatures between 60°F and 120°F. Some microorganisms can survive in much colder temperatures of 32°F to 40°F. That is why extreme heat and freezing temperatures are used in food preservation.
Water	Water is one of the most important nutrients needed by microorganisms for growth. Water that is not bound by any other agent, such as salt, is "free" to be used by the microorganisms. When salt or sugar is added to food, the water is bound to the salt or sugar and is not available for use by the microorganisms. The same action occurs in freezing. The freezing temperature converts the water to ice, which cannot be used for microbial growth.

Basic Principles and Effects of Food Processing Methods

Process	Principle of Preservation	Effects on Food
Chemical (Additives)	The growth of microorganisms is inhibited.	Quality, taste, texture, and color are retained. The function of ingredients is improved.
Curing (Pickling, Salting, Sugaring)	The addition of acids lowers pH levels, which inhibits microbial growth. Salt and sugar inhibit microbial growth by decreasing the availability of water.	Shelf life is extended. Texture and color may be affected.
Drying	The water that microorganisms need for growth is removed.	Flavor and appearance are affected. Some nutrients are lost. Shelf life is extended.
Fermentation	The acidity of the culture lowers the pH level, therefore reducing growth of microorganisms.	Flavor and appearance may be affected. Shelf life is extended.
Freezing	Low temperatures convert water to ice, which makes water unavailable to microorganisms for growth. It reduces enzymatic changes.	Texture may be affected, but color, flavor, and nutrients are retained.
Heat Sterilization (Canning)	Harmful microorganisms are destroyed. Enzymatic changes are reduced.	Some loss of heat-sensitive nutrients and water-soluble vitamins may occur. Flavor, texture, and color may change slightly. Lengthy shelf life stability is provided.
Irradiation	Beta or gamma rays are used to destroy harmful microorganisms.	Chemical reactions may affect flavor, color, or texture. Extended shelf life is provided.
Other Heat Sterilization Methods (Pasteurization, Smoking)	Harmful microorganisms are destroyed.	Heat-sensitive nutrients are lost. Shelf life is extended.
Refrigeration	Growth of microorganisms is slowed down or stopped by the low temperatures.	Flavor, color, and texture is retained, but the shelf life is very short. After periods of time, microbial growth can occur.

Laboratory Experiment: Freezing Vegetables

◆ Freezing is a popular method of food preservation because it is one of the simplest and least time consuming ways to preserve food, and it results in high quality food. The freezing method of food preservation retains the natural color, fresh flavor, and nutritive value of most foods, especially fruits and vegetables. Frozen fruits and vegetables are convenient to use because most of the preparation they require before serving has been done before freezing. Harvesting fruits and vegetables at the peak of development, and freezing them as soon as possible retains maximum flavor and nutritive value and minimizes bacterial growth. Freezing is an effective method of food preservation because the low storage temperature (-18°C , 0°F) inhibits the growth of microorganisms.

Laboratory instructions:

Read carefully all of the information on the procedures for this laboratory experiment. The experiment is divided into two parts. Part I involves the blanching of the vegetables. Part II involves conducting the catalase test on the blanched vegetables to determine if the heat treatment was sufficient to inactivate the enzymes that would cause undesirable changes in the food.

Part I: Blanch vegetables.

Part II: Conduct catalase test on blanched vegetables. Immediately after blanching, pack vegetables for freezing. Seal, label, and freeze at 0°F or below.

Laboratory Experiment: Freezing Vegetables, Cont'd**Part I: Blanch Vegetables**Experimental Procedure

Prepare any of the following available vegetables using optimum blanching time prior to freezing for half of each vegetable and no blanching for the other half. Properly label the vegetable samples, store them for at least three months, and then remove them from the freezer. Cook and compare color, texture, and flavor. In this laboratory, freeze and store vegetables (for evaluation next semester) and then remove vegetables which were frozen last semester from the freezer and cook and evaluate them.

1. Wash vegetables thoroughly in cold water, lifting them out of the water so the grit settles to the bottom of the water.
2. Peel if needed, trim, and cut vegetables into suitable size pieces:
Carrots — thin slices or lengthwise strips
Field (blackeye) peas — shell the peas
Green beans — remove the ends and cut beans into 1 or 2-inch pieces
Squash — 1/2-inch slices
3. Blanch. For each pound of prepared vegetables use 1 gallon boiling water in a blancher or kettle. Place vegetable in balancing basket, wire basket, or nylon net bag and lower into boiling water. Place lid on container and keep covered during entire heating period. Keep the heat on high so that the water will continue boiling vigorously. Start counting heating time as soon as vegetable is put into boiling water. Heating time varies with the type of vegetable, maturity, and size of pieces. At higher altitudes (5,000 feet or more above sea level) heat 1 minute longer than the time specified.

<u>Vegetable</u>	<u>Blanching Time (minutes)</u>
Carrots	2
Field (blackeye) peas	4
Green beans	3
Squash	3

4. Immediately after cooking, plunge basket or bag of vegetables into a large container of ice water and cool. It takes about as long to cool vegetables as to heat them. When vegetables are cool, remove them from water and drain on clean, heavy towels.

Laboratory Experiment: Freezing Vegetables, Cont'd.

Part I: Blanch Vegetables, Cont'd.

5. Test for adequate blanching by using any of the tests stated on the next page.
6. Pack into moisture-vapor-proof containers, leaving 1/2-inch headspace for the four vegetables named above. Seal, label appropriately (vegetable, treatment, and date), and freeze immediately. Store at 0°F or below.

Part II: The Catalase Test: Test for Adequate Blanching

▲ Adequacy of the blanching process can be checked by chemical tests. This should be done immediately after blanching and before freezing the food in order to benefit from the information.

The two most common tests used for this purpose are the catalase test and the peroxidase test. Catalase and peroxidase are not the only enzymes that cause problems in frozen foods; however, when these two enzymes are inactivated, other enzymes that might cause undesirable changes are also inactivated.

In this laboratory experiment, you will be performing the catalase test. Catalase decomposes hydrogen peroxide to oxygen and water.

Materials needed:

- Test tubes
- Test tube rack
- Beaker or graduated cylinder
- 3 percent hydrogen peroxide solution
- Blanched vegetables
- cutting board
- chopping knife

Procedure:

Place a small quantity of blanched vegetable fragments in a glass test tube. Add enough 3 percent hydrogen peroxide solution to cover the vegetable about one inch. If no gas is given off within a few minutes the catalase enzyme is considered to be inactivated. A stream of little gas bubbles rising to the surface after the hydrogen peroxide is added indicates that the heat treatment was insufficient.

Prepare a data table or other tool to record your observations. Write your conclusions as directed by your teacher.

The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Microwave Cookery

Objective: To determine the effects of various cooking utensils on food product quality in microwave cookery.

Supplies:

- fresh broccoli
- assorted microwave-safe cookware (glass, opaque glass, plastic) in a variety of sizes
- microwave
- water
- timer
- labels
- knives, forks, paper plates for taste-testing

Procedure:

1. Wash and clean broccoli. Trim stalks by cutting away the tough part of the stalks. Wash again.
2. Divide the broccoli into equivalent portions based on the number of utensils you are testing.
3. Write labels for each of the utensils (e.g., A: 1 qt. glass, 7 minutes; B: 2 qt. glass, 7 minutes, etc.)
4. Pour 1/4 cup water into each of the utensils being tested. Add an equivalent amount of fresh broccoli to each.
5. Microwave each utensil separately for 7 minutes, rotating 1/2 turn after 3 1/2 minutes.
6. Remove from microwave and label carefully.
7. Cut broccoli into small pieces for taste-testing.

Observations:

1. Record the color and texture of each sample.
2. Taste each sample separately. Record flavor, texture/feel in your mouth, and sound (crunchiness) for each sample.
3. Share your observations with the class as directed by your teacher.

Enrichment:

Additional experiments can be conducted testing utensils most effective in microwave cooking.

Examples include the following:

- Testing a variety of microwavable utensils for cooking and browning meat
- Testing a variety of vegetables
- Testing baked products

The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Stovetop Cookery

Objective: To determine the effects of various cooking utensils on food product quality in stovetop cookery.

Supplies:

- fresh broccoli
- assorted stovetop cookware (aluminum, stainless steel, cast iron, glass, opaque glass) in a variety of sizes
- range
- water
- timer
- labels
- knives, forks, paper plates for taste-testing

Procedure:

1. Wash and clean broccoli. Trim stalks by cutting away the tough part of the stalks. Wash again.
2. Divide the broccoli into equivalent portions based on the number of utensils you are testing.
3. Write labels for each of the utensils (e.g., A: 2 qt. glass, 18 minutes; B: 2 qt. aluminum, 18 minutes, etc.)
4. Pour 1 cup water into each of the utensils being tested. Add an equivalent amount of fresh broccoli to each.
5. Cook broccoli in each utensil separately for 18 minutes.
6. Remove from heat and label carefully.
7. Cut broccoli into small pieces for taste-testing.

Observations:

1. Record the color and texture of each sample.
2. Taste each sample separately. Record flavor, texture/feel in your mouth, and sound (crunchiness) for each sample.
3. Share your observations with the class as directed by your teacher.

Enrichment:

Additional experiments can be conducted testing utensils most effective in stovetop cooking. Examples include the following:

- Testing a variety of utensils for cooking and browning meat; especially pan-frying
- Testing a variety of vegetables
- Testing gravies and sauces

The Effects of Various Cooking Utensils and Equipment on Food Product Quality in Baking

Objective: To determine the effects of various cooking utensils on food product quality in baking.

Supplies:

- ingredients for 1 recipe of cookies (see recipe below)
- assorted bakeware (glass baking dish, opaque glass baking dish, shiny and dark-coated baking sheets, stainless steel baking sheet, baking stone)
- oven
- timer
- labels
- knives, forks, paper plates for taste-testing

Procedure:

1. Prepare the cookie dough according to procedures in the recipe.
2. Divide the dough into equivalent portions based on the number of utensils you are testing.
3. Write labels for each of the utensils (e.g., A: glass baking pan; B: dark-coated aluminum baking sheet, etc.)
4. Using the drop cookie method, place equivalent amounts of dough for each cookie on the utensils being tested.
5. Bake cookies according to recipe instructions. Cool.
6. Transfer cookies to paper plates and label accordingly.
7. Cut cookies into small pieces for taste-testing.

Observations:

1. Record the color and texture of each sample.
2. Taste each sample separately. Record flavor, texture/feel in your mouth, and sound (crunchiness) for each sample.
3. Share your observations with the class as directed by your teacher.

Chocolate Chip Cookies

2/3 c. shortening	1 1/2 c. flour
1/2 c. granulated sugar	1/2 t. baking soda
1/2 c. brown sugar	1/2 t. salt
1 egg	1 c. semi-sweet chocolate chips
1 t. vanilla	

Preheat oven to 350° F. Measure into mixing bowl and beat together the shortening, sugar, brown sugar, egg, and vanilla. Mix thoroughly. In a separate bowl, measure and mix together the flour, soda, and salt. Gradually add the flour mixture to the shortening mixture and mix thoroughly. Stir the chocolate chips into the dough by hand. Drop rounded teaspoonfuls about 2 inches apart onto an ungreased baking sheet. Bake 10-12 minutes. Cool 5 minutes before removing from pan.

Yield: 3 dozen cookies.

The Effects of Temperature on Food Products

Objective: To determine the effects of temperature on food products.

Experiment #1: The effect of heat on protein foods — Use Teaching Aids 7-10 to assist with laboratory procedures and evaluation.

- Test A: • Place 2 large eggs in a saucepan and cover with cold water. Bring to a boil and simmer (do not boil) for 15 minutes. Remove from heat and cool immediately under cool, running water. Peel, slice, and observe results.
- Test B: • Place 2 large eggs in a saucepan and cover with cold water. Bring to a boil and continue boiling (a full, rolling boil) for 20 minutes. Remove from ~~heat~~ and peel as soon as cool enough to handle. Slice and observe results.
- When exposed to high heat, the hydrogen sulfide in the egg white combines with the iron in the yolk to form ferrous sulfide. This causes a greenish discoloration on the surface between the white and the yolk. Although harmless, the green color caused by the ferrous sulfide is not appealing to the consumer.
- Test C: • Beat 2 large eggs with 1 T. milk in a bowl. Melt 2 t. fat in skillet. Pour beaten egg mixture into melted fat and scramble eggs over low heat until light and fluffy. Observe results and follow appropriate taste-test procedures.
- Test D: • Beat 2 large eggs with 1 T. milk in a bowl. Melt 2 t. fat in skillet. Pour beaten egg mixture into melted fat and scramble eggs over high heat until all moisture has disappeared. Observe results and follow appropriate taste-test procedures.
- The eggs cooked over low heat will be soft, light, and fluffy. The eggs cooked over high heat will be hard, dry, and rubbery.

Experiment #2: The effect of heat on baked products — Prepare biscuits following the recipe below.

- Test A: • Divide dough in half. Cut into biscuits using biscuit cutter or small glass. Bake one-half of biscuits at 325° F. for 10-12 minutes.
- Test B: • Bake the remaining biscuits at 425° F. for 10-12 minutes.
- Observe the results. Follow appropriate taste-test procedures. Record your evaluation of the two products on Teaching Aid 57, *Biscuit and Muffin Scorecard*.

Biscuits

2 c. all-purpose flour
1 T. baking powder
1/2 t. salt

1/3 c. shortening
2/3 c. to 3/4 c. milk

Preheat oven to temperature directed by the experiment. Combine the flour, baking powder, and salt in large mixing bowl. Using a pastry blender or two table knives, cut in shortening until the mixture resembles coarse cornmeal or very small peas. Add milk, stirring with a fork until the mixture forms a soft dough. Turn dough onto lightly floured board. Knead 10 times. Roll dough with rolling pin until 1/2 inch thickness. Cut into biscuits with biscuit cutter or small glass. Place on ungreased baking sheet. Bake 10-12 minutes. Remove from oven. Makes 15 small biscuits.

The Effects of Temperature on Food Products: Critical Thinking

Directions: Work with a partner to complete the following activities. Write your responses to the questions in the space provided.

1. Gather the following items and examine under a microscope a piece of the flesh/skin from each.
 - poultry frozen for one month and poultry frozen six months or more
 - poultry refrigerated for one day and poultry refrigerated for one week
 - fresh poultry and poultry left out on the countertop overnight
 - a) What differences do you notice?
 - b) Which would you prefer to eat? Why?
2. Visit a grocery store. Locate the thermostats in the refrigerated storage areas and freezer compartments.
 - a) What are the temperatures?
 - b) Are they within the safety range?
 - c) What food storage facilities does the grocer have in the back of the store?
 - d) What consequences could there be if the temperatures of food storage areas are too warm?

The Effects of Manipulative Procedures on Food Products

Objective: To determine the effects of manipulative procedures on food products.

Experiment #1: The effect of manipulative procedures on muffins

- Prepare muffins following recipe below. Observe the results. Follow appropriate taste-test procedures. Record your evaluation of the two products on Teaching Aid 57, *Biscuit and Muffin Scorecard*.

Muffins

2 c. flour
3 t. baking powder
6 T. sugar
1/2 t. salt

1 egg, well beaten
1 cup milk
5 T. melted shortening

Preheat oven to 400° F. Grease muffin pan or line with paper baking cups.

Test A: Stir flour, baking powder, sugar, and salt into large mixing bowl. In a small mixing bowl, beat together the egg, milk, and melted shortening. Make a well in the center of the flour mixture. Pour the egg mixture into the well. Stir just until ingredients are blended. Batter should be lumpy. Do not over-beat. Fill muffin cups 2/3 full. Bake at 400° F. for 20-25 minutes. Remove from pan. Cool.

Test B: Stir flour, baking powder, sugar, and salt into large mixing bowl. In a small mixing bowl, beat together the egg, milk, and melted shortening. Using an electric mixer, slowly add egg mixture and beat at medium speed 2-3 minutes or until no lumps appear. Fill muffin cups 2/3 full. Bake at 400° F. for 20-25 minutes. Remove from pan. Cool.

Experiment #2: The effect of manipulative procedures on yeast bread

- Prepare yeast bread following recipe below. Observe the results. Follow appropriate taste-test procedures. Record your evaluation of the two products on Teaching Aid 58, *Yeast Bread and Pastry Scorecard*.

Yeast Bread

1 c. milk
1 1/2 T. sugar
1/2 t. salt
1 T. shortening

1 pkg. active dry yeast
1/4 c. warm water
3 - 3 1/2 c. flour

Scald milk in small saucepan; add sugar, salt, and shortening. Pour into large mixing bowl and cool to 80°-85° F. (lukewarm). Mix the dry yeast and 1/4 c. warm water with a fork; add to milk mixture. Add 1 1/2 c. flour and beat with a spoon until a smooth batter forms. Stir in enough additional flour to make a soft dough. Turn dough onto lightly floured board and let rest for 5 minutes. Divide dough in half.

Test A: Knead one-half of the dough about 10 minutes until smooth and small blisters appear on the surface of the dough. Place dough in greased bowl, turn to grease top, cover, and let rise in a warm place for 1 to 1 1/2 hours. Punch dough down and let rest 10 minutes. Shape into loaf and place in small greased loaf pan. Cover and let rise in warm place about 30-45 minutes until doubled. Bake at 425° F. for 25 minutes. Remove from pan and cool.

The Effects of Manipulative Procedures on Food Products. Cont'd.

Yeast Bread, cont'd.

Test B: Place dough in greased bowl, turn to grease top. Cover and let rise in a warm place for 1 to 1 1/2 hours. Punch dough down and let rest 10 minutes. Shape into loaf and place in small greased loaf pan. Cover and let rise in warm place about 30-45 minutes until doubled. Bake at 425° F. for 25 minutes. Remove from pan and cool.

Experiment #3: The effect of manipulative procedures on pastry

- Prepare pastry following recipe below. Observe the results. Follow appropriate taste-test procedures. Record your evaluation of the two products on Teaching Aid 58, *Yeast Bread and Pastry Scorecard*.

Pastry

2 c. flour
1 t. salt

2/3 c. shortening
4-5 T. cold water

Preheat oven to 425° F. Use two small baking sheets. With a small strip of aluminum foil and black marker, label one pan "Test A" and the other pan, "Test B".

Place flour, salt, and shortening in large mixing bowl. Using a pastry blender or two table knives, cut shortening into flour mixture until the mixture resembles coarse cornmeal or small peas. Add cold water slowly while mixing with a fork. Stir until dough forms a ball. Divide dough in half.

Test A: Place one half of pastry dough between two 12"x12" sheets of waxed paper. Roll to 1/8" thickness with rolling pin. Remove top sheet of waxed paper and transfer dough to baking sheet. With a table knife, score pastry into 1 1/2" x 2 1/2" rectangles, but do not separate. Prick each rectangle two times with fork. Bake 8 to 10 minutes until golden brown. Cool.

Test B: Place one half of pastry dough between two 12"x12" sheets of waxed paper. Roll to 1/8" thickness with rolling pin. Remove top sheet of waxed paper and form into ball. Cover with top sheet of waxed paper and roll again. Repeat this procedure three more times. (You will have rolled the dough five times.) Remove top sheet of waxed paper and transfer dough to baking sheet. With a table knife, score pastry into 1 1/2" x 2 1/2" rectangles, but do not separate. Prick each rectangle two times with fork. Bake 8 to 10 minutes until golden brown. Cool.

The Effects of Leavening Agents on Food Products: Air

Objective: To determine the effects of leavening agents on food products.

Experiment #1: The effect of air as a leavening agent in food products

- Prepare angel food cake following the recipe below. Measure the volume of the cake batter prior to baking by inserting a wooden skewer into the center of the batter in the pan. Remove the skewer and mark the height of the batter, then measure with a ruler. Record this information on Teaching Aid 59, *Air, Steam, and Yeast as Leavening Agents Scorecard*. Measure the volume of the baked cake by performing the same test with the wooden skewer into the cooled cake. Mark the height on the skewer and then measure with a ruler. Record this information on the scorecard.

KEY QUESTION: How much was the volume increased by the leavening action of air?

Angel Food Cake

1 1/2 c. egg whites
1 t. cream of tartar
1/2 t. vanilla extract
1/2 t. almond extract

1 1/4 c. cake flour
1 3/4 c. white sugar
1/4 t. salt

Beat egg whites until they form stiff peaks. Add cream of tartar, vanilla extract, and almond extract. Sift together the flour, sugar, and salt. Repeat five times. Gently combine the egg whites with the dry ingredients. Pour into an ungreased 10 inch tube pan. Place cake in cold oven. Turn the oven on and set it to 325° F. Cook for 1 hour or until the cake is golden brown. Invert cake on funnel or bottle and cool completely in the pan. When cool, remove from pan.



The Effects of Leavening Agents on Food Products: Steam

Objective: To determine the effects of leavening agents on food products.

Experiment #2: The effect of steam as a leavening agent in food products

- Prepare popovers following the recipe below. Measure the volume of the popover batter prior to baking by inserting a wooden skewer into the center of the batter in the pan. Remove the skewer and mark the height of the batter, then measure with a ruler. Record this information on Teaching Aid 59, *Air, Steam, and Yeast as Leavening Agents Scorecard*. Measure the volume of the baked popovers by performing the same test with the wooden skewer into a cooled popover. Mark the height on the skewer and then measure with a ruler. Record this information on the scorecard.

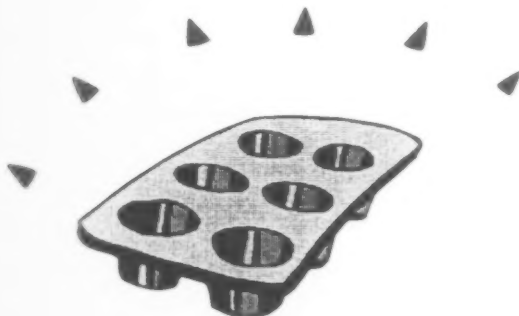
KEY QUESTION: How much was the volume increased by the leavening action of steam?

Popovers

1 c. all purpose flour
1/2 t. salt

1 c. milk
2 large eggs

Preheat oven to 400° F. Grease six custard cups or deep muffin pans. Mix flour and salt together in a large mixing bowl. Add milk and eggs. Beat with electric mixer until smooth. Pour into custard cups, filling each one two-thirds full. Bake popover for 30 minutes, or until puffed and light golden brown. Reduce heat to 350° F. and continue baking for another 15 minutes. After baking, remove from custard cups and serve immediately.



The Effects of Leavening Agents on Food Products: Yeast

Objective: To determine the effects of leavening agents on food products.



Experiment #3: The effect of yeast as a leavening agent in food products

- Prepare cinnamon rolls following the recipe below. Measure the volume of the roll dough prior to baking by measuring the height of a cinnamon roll with a ruler prior to baking. Record this information on Teaching Aid 59, *Air, Steam, and Yeast as Leavening Agents Scorecard*. Measure the volume of the baked cinnamon rolls by measuring the height of a baked roll with a ruler. Record this information on the scorecard.

KEY QUESTION: How much was the volume increased by the leavening action of yeast?

Cinnamon Sweet Rolls

1/4 c. warm water (110° -115° F.)	3/4 t. salt
1 pkg. active dry yeast	1 egg
3/4 c. warm milk (110° -115° F.)	3 T. butter
1/4 c. sugar	3 1/2 to 3 3/4 c. flour

In mixing bowl, combine water and yeast. Add the warm milk, sugar, salt, eggs, and butter. Add 2 cups of the flour. Mix until smooth, adding enough of the remaining flour to handle easily. Turn out onto floured board and knead 10 minutes until smooth and elastic, adding a little flour if too sticky. Place dough in greased bowl and turn so as to grease surface of the dough. Let rise in warm place (85° F.) until double in bulk; about 1 1/2 hours. Punch dough down. Turn onto lightly floured surface. Let rest for 10 minutes.

Filling:	1/2 c. brown sugar	1/4 c. butter
	2 T. flour	1/4 c. raisins, plumped
	1 1/2 t. cinnamon	1/4 c. chopped pecans

Combine brown sugar, 2 T. flour, and cinnamon. Cut in butter until crumbly. Set aside. Roll the dough into a rectangle. Sprinkle filling over dough; top with raisins and pecans. Roll up jelly roll style and pinch edges to seal. Slice dough into 6-1" slices. Arrange in greased pan, cut side up. Cover loosely and let rise until double, about 45 minutes.

Preheat oven to 375° F. Bake for 25-30 minutes. Drizzle with glaze.

Glaze: 3/4 c. powdered sugar, 1/2 t. corn syrup, 1/4 t. vanilla, and 1 T. milk. Mix together until smooth and drizzle over hot rolls.

The Effects of Chemical Leavening Agents on Food Products

Objective: To determine the effects of leavening agents on food products.

Experiment #4: The effect of baking powder as a chemical leavening agent in food products

- Prepare pancakes following the recipe below. Measure the volume of the pancake batter prior to cooking by inserting a wooden skewer into the center of one pancake immediately after pouring on griddle. Remove the skewer and mark the height of the batter, then measure with a ruler. Record this information on Teaching Aid 60, **Chemical Leavening Agents Scorecard**. Measure the volume of the cooked pancakes by performing the same test with the wooden skewer into a cooled pancake. Mark the height on the skewer and then measure with a ruler. Record this information on the scorecard.

KEY QUESTION: How much was the volume increased by the leavening action of baking powder?

Pancakes

1 c. all purpose flour
1 t. baking powder
1 t. sugar
1/2 t. salt

1 large egg, slightly beaten
1 c. milk
2 T. melted butter

Sift the flour, baking powder, sugar, and salt together into a large mixing bowl. Make a well in the center of the flour mixture and pour in the egg and milk. Mix with large spoon only until ingredients are blended. Add the melted butter. Batter should be lumpy. Heat a lightly greased griddle or skillet until droplets of water evaporate instantly. Pour the batter onto the hot griddle into 4 inch rounds. Cook 2-3 minutes until small bubbles appear on the surface of the pancakes. Turn immediately with a spatula and cook 1 more minute until the bottom is golden brown. Serve warm. Makes 10 pancakes.



The Effects of Chemical Leavening Agents on Food Products

Objective: To determine the effects of leavening agents on food products.

Experiment #5: The effect of baking soda as a chemical leavening agent in food products

- Prepare brown bread following the recipe below. Measure the volume of the batter prior to cooking by inserting a wooden skewer into the center of the batter immediately after pouring in the coffee can. Remove the skewer and mark the height of the batter, then measure with a ruler. Record this information on Teaching Aid 60, *Chemical Leavening Agents Scorecard*. Measure the volume of the baked bread by performing the same test with the wooden skewer into a cooled loaf. Mark the height on the skewer and then measure with a ruler. Record this information on the scorecard.

KEY QUESTION: How much was the volume increased by the leavening action of baking soda?

Brown Bread

1 c. whole wheat flour	3/4 c. raisins
1 c. rye flour	2 c. buttermilk
1 c. cornmeal	3/4 c. dark molasses
1 1/2 t. baking soda	2 T. melted shortening
1 t. salt	

Preheat oven to 350° F. Grease three 1 pound coffee cans. In large mixing bowl, combine the whole wheat and rye flours, cornmeal, soda, salt, and raisins. Mix well. Combine the buttermilk, molasses, and melted shortening together. Add to the flour mixture and stir until thoroughly mixed. Pour batter into greased coffee cans filling about two-thirds full. Cover the coffee cans with foil. Place coffee cans on a rack inside a shallow baking pan. Pour boiling water into the shallow pan until it is about 2 inches deep. Bake 2-3 hours. Cool in cans 15 minutes and remove from cans. Best if served warm. Makes 3 small loaves.



BISCUIT AND MUFFIN SCORECARD

Scoring Scale:

6 = Extremely desirable

5 = Moderately desirable

4 = Slightly desirable

3 = Slightly undesirable

2 = Moderately undesirable

1 = Extremely undesirable

BISCUITS		
Treatment/Characteristics	Test A: Biscuits baked at 325° F.	Test B: Biscuits baked at 425° F.
Appearance Level top; straight sides; golden brown color; doubled in size during baking		
Tenderness Light and tender; does not crumble		
Texture Medium fine grain; slightly moist		
Flavor Pleasing, well-blended flavor		
Total score (24 possible points) _____		

MUFFINS		
Treatment/Characteristics	Test A: Mixed by hand	Test B: Mixed with electric mixer
Appearance Rounded, pebbly top; golden brown color; creamy white interior		
Tenderness Light and tender; does not crumble		
Texture Medium fine texture, slightly moist, free from tunnels		
Flavor Pleasing, well-blended flavor; slightly sweet	267	
Total score (24 possible points) _____		

Yeast Bread and Pastry Scorecard

Scoring Scale:

6 = Extremely desirable

5 = Moderately desirable

4 = Slightly desirable

3 = Slightly undesirable

2 = Moderately undesirable

1 = Extremely undesirable

YEAST BREAD		
Treatment/Characteristics	Test A: Kneaded dough	Test B: Dough not kneaded
Appearance Rounded top; golden brown color; even shape; creamy white interior		
Tenderness Light and tender; tender crust		
Texture Fine grain; slightly moist; soft texture		
Flavor Pleasing, well-blended flavor		
Total score (24 possible points) _____		

PASTRY		
Treatment/Characteristics	Test A: Dough rolled 1 time	Test B: Dough rolled 5 times
Appearance Equivalent in thinness all over; light, golden brown color; blistered appearance		
Tenderness Light and tender; does not crumble; is not tough		
Texture Delicate, flaky texture		
Flavor Rich, delicate flavor; does not taste salty or overcooked	268	
Total score (24 possible points) _____		

Air, Steam, and Yeast as Leavening Agents Scorecard

Directions: Record data, observations, and taste-test results for each of the experiments.

Characteristics	Leavening Agent: AIR	Leavening Agent: STEAM	Leavening Agent: YEAST
Height (measure volume)			
Appearance (describe)			
Tenderness (describe)			
Texture (describe)			
Flavor (describe)		269	

Chemical Leavening Agents Scorecard

Directions: Record data, observations, and taste-test results for each of the experiments.

Characteristics	Chemical Leavening Agent: BAKING POWDER	Chemical Leavening Agent: BAKING SODA
Height (measure volume)		
Appearance (describe)		
Tenderness (describe)		
Texture (describe)		
Flavor (describe)	270	

Principles of Food Preparation

1. Selection of Food

- Ingredients must be fresh
- Food products must be at the proper stage of maturity

2. Preliminary Treatment of Food

- Proper washing and cleaning
- Appropriate mechanical treatment of the food (paring, cutting, chopping, dicing, slicing, etc.)

3. Preservation of Nutrients

- Appropriate preparation and cooking procedures must be followed to preserve nutrients (e.g., avoid overexposure to air, soaking, overcooking, use of too much water in cooking)

4. Seasoning

- Appropriate amounts of seasonings enhance the flavor of foods; over use of seasonings can make the foods offensive to some individuals or otherwise mask more pleasing natural flavors

5. Cooking Techniques

- Equipment: select appropriate type and size; use standardized measuring tools; accurate thermometers and thermostats in ovens and small appliances
- Recipes: selection of appropriate recipes based on access to ingredients and food preparation skills
- Skills: knowledge of food preparation information, skills, procedures, and techniques
- Timing: efficient and accurate use of time in all food preparation procedures

6. Methods of Cookery

- Air: roasting, baking, broiling (conventional and convection)
- Water: boiling, simmering, stewing, poaching
- Steam: cooked in water vapor above the water (pressure cooking, steam basket)
- Fat: sautéing, pan frying, deep fat frying
- Combination: pot roasting, braising
- Direct heat transfer: cooking on grill, griddle, waffle iron
- Electronic heat transfer: microwave cooking

7. Serving of Food

- Presentation of prepared food with attention to color and appearance greatly affects its appeal and acceptance.

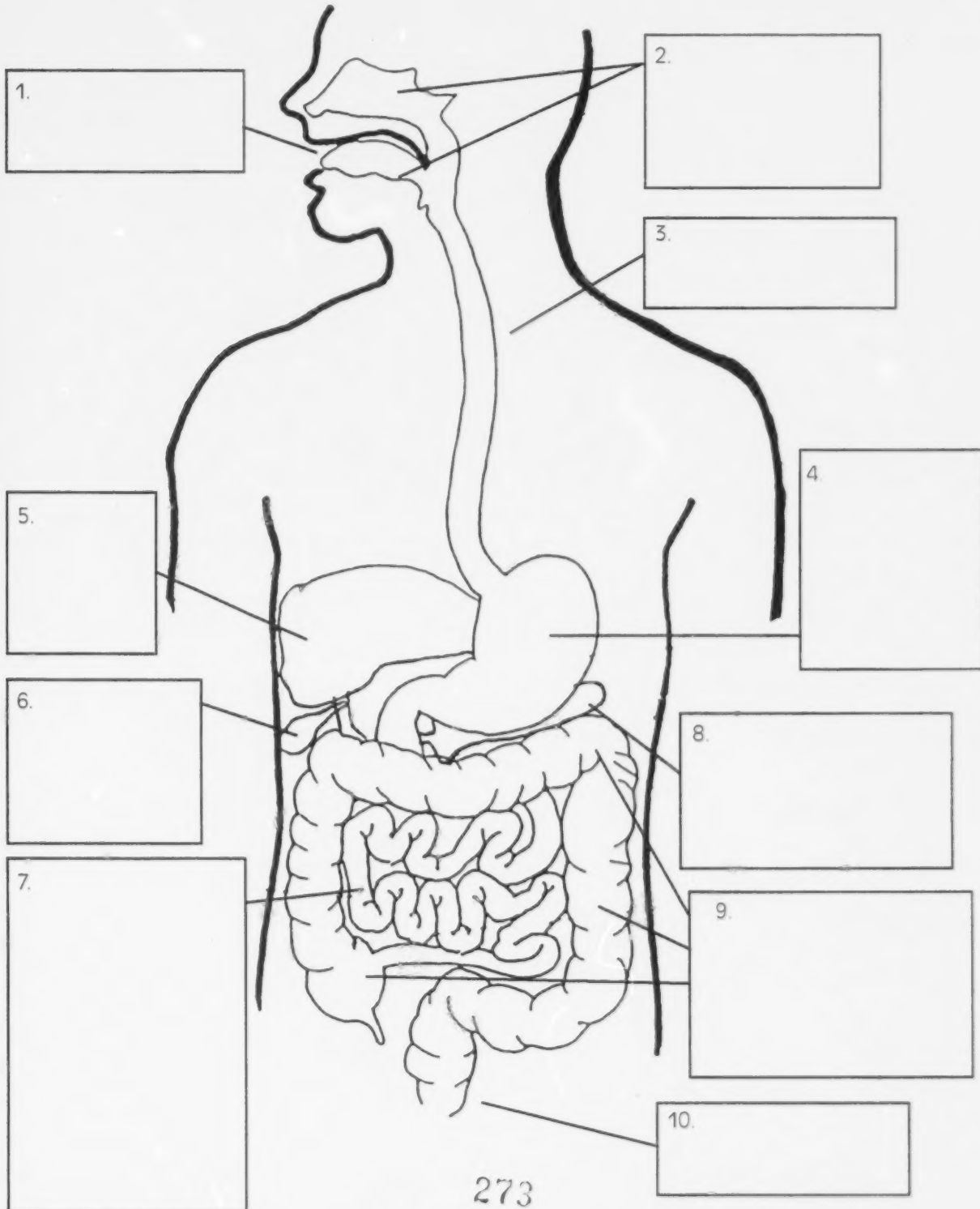
Critical Thinking: The Principles of Food Preparation

Directions: Work with a partner to complete the following activities. Write your responses to the questions in the space provided.

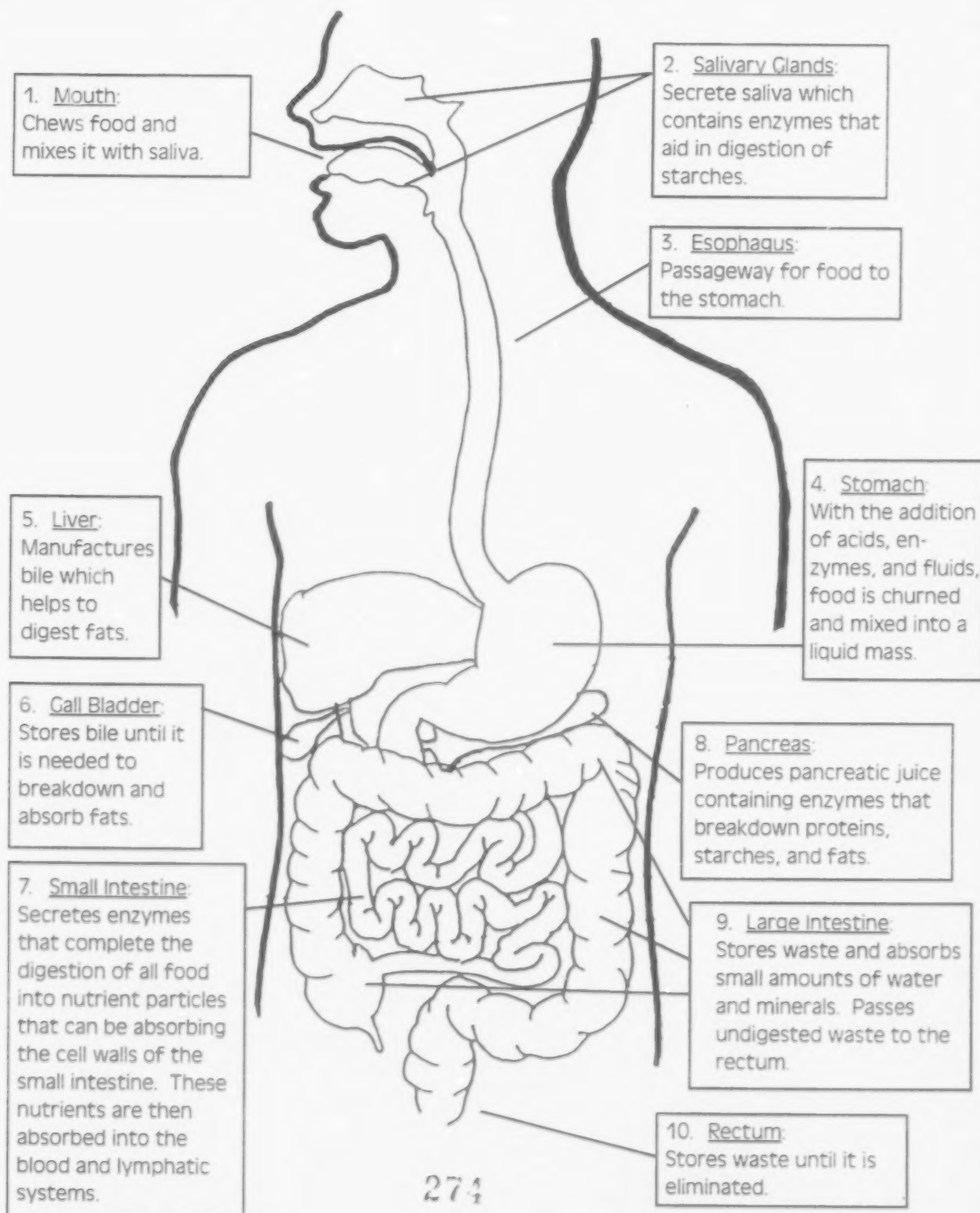
- 1) Assume you are the manager of a large cafeteria. Serving time for lunch begins at eleven o'clock. A few workers could not come to work so those that are there must work as fast as they can. Ten meat dishes must be prepared, fifteen vegetable dishes, plus various salads, breads, and desserts. Once cooked, they must be held in warmers or coolers until needed. The cafeteria operates a continuous serving line until eight o'clock in the evening. Some foods may be kept in the warmer for six or seven hours.
 - a) What may happen to the quality of the food if it stays in a warmer for a long period of time after it is cooked?
 - b) How might the nutritional value of the foods be affected by the long holding periods?
- 2) Research the term "vegetable oil." Compose an accurate definition for consumers. Examine the labels on a variety of vegetable oil containers and identify the type of vegetable oil used. Determine if the products contain primarily saturated or polyunsaturated fat. Compare the cost of the primarily saturated fats with the cost of the polyunsaturated fats. What reasons can you give to justify the cost difference?
- 3) Investigate the types of vegetable oils used by local fast-food establishments.
 - a) Are they primarily saturated or polyunsaturated products?
 - b) What assumptions are made by consumers as a result of advertising claims about the use of vegetable oils by these restaurants?

The Digestive System

Directions: Write the name of the part of the digestive system in the blank. Then write the function of each part of the digestive system in the space provided.



The Digestive System: Answer Key



LABORATORY EXPERIMENT: HOW DOES THE BODY USE FOOD?

Objective: To illustrate how the breakdown of food through the digestive process enables the nutrients to be absorbed by the body and utilized for basal and energy metabolism

Experiment:

- Materials:
- potatoes
 - water
 - 4 clear beakers or drinking glasses
 - measuring spoons
 - iodine
 - dropper
 - grater

Procedure:

1. Peel a potato and cut it in half.
 2. Put half of the potato into one of the beakers.
 3. Grate the other half of the potato and put it in another beaker.
 4. Fill the glasses two-thirds full with water and stir gently.
 5. Take five teaspoons of potato water from each beaker and put it in two separate clean beakers. Label them to reflect the water from the whole potato half and the water from the grated potato.
 6. Add one drop of iodine to the two beakers containing 5 tsp. each of potato water.
 7. Note the changes in the water. Record your observations as directed by your teacher.
- ◆ Iodine is a test for starch. Grating the potato made it easier for the starch to be released from the potato and into the water. In the same manner, the whole digestive process breaks down food so that the nutrients can be utilized by the body.

CALCULATING YOUR BMR

▲ Many factors affect an individual's basal metabolic rate. However, a simple mathematical formula can be used to approximate BMR. Basal metabolic rate is affected by gender, as well as other factors. Therefore, the following numbers generally are used in calculating BMR for males and females.

BMR factor for males = 1 kcal per kg of body weight per hour

BMR factor for females = 0.9 kcal per kg of body weight per hour

Thus, males have a slightly higher BMR factor than females.

Legend kcal = kilocalorie kg = kilogram lb = pound

Formula to figure approximate BMR

1. First, body weight must be converted from pounds (lbs.) to kilograms (kg).

$$\frac{\text{weight in pounds}}{2.2} = \text{weight in kilograms (kg)}$$

2. Multiply the body weight in kg by the BMR factor to find the kcal used per hour for basal metabolism.

$$\text{weight in kg} \times \text{BMR factor (1.0 for males; 0.9 for females)} = \text{kcal used per hour}$$

3. Multiply the kcal used per hour times 24 to calculate the kcal used per day for basal metabolism.

$$\text{kcal used per hour} \times 24 = \text{total kcal needed per day for basal metabolism}$$

This figure is the BMR.

4. Figure the BMR for a 165 lb. male.

$$1) \quad \frac{165 \text{ lb}}{2.2} = 75 \text{ kg}$$

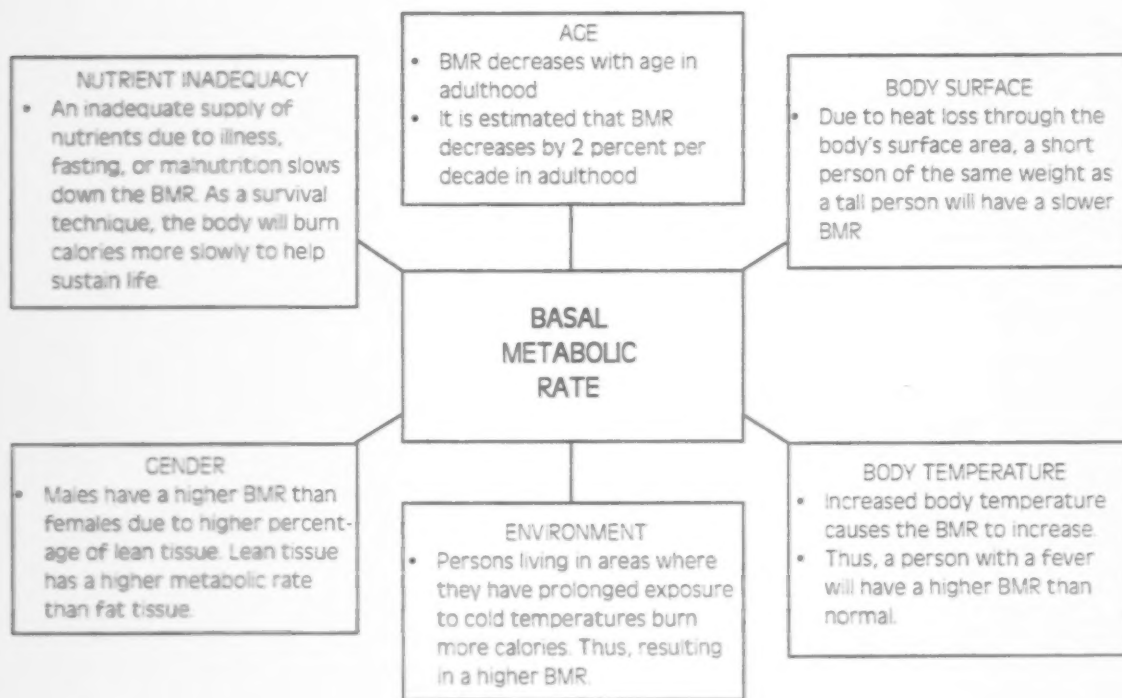
$$2) \quad 75 \text{ kg} \times 1.0 = 75 \text{ kcal used per hour}$$

$$3) \quad 75 \text{ kcal} \times 24 \text{ hrs.} = 1800 \text{ kcal}$$

$$4) \quad \text{BMR} = 1800 \text{ kcal per day}$$

5. Figure your own BMR.

FACTORS THAT AFFECT BASAL METABOLIC RATE



CRITICAL THINKING

1. Would the BMR of a 150 lb. man living at the South Pole be the same as that of a 150 lb. man living in Bolivia? Why? How would the BMR of the two men compare?
2. When Susie was fourteen she was 5'4" tall and weighed 110 lbs. By her fifteenth birthday, she was 5'8" tall and still weighed 110 lbs. What happened to her BMR?
3. What accounts for the BMR factor for males being higher than the BMR factor for females?

FIGURING TOTAL ENERGY NEEDS

By considering your daily lifestyle, activity level, and BMR, you can calculate your approximate total energy needs (kcal) per day using the following formula.

$$\text{AM} + \text{BMR} + \text{SDE} = \text{total kcal needed per day}$$

AM = activity metabolism (kcalories needed for activities)

BMR = basal metabolic rate

SDE = specific dynamic effect (the energy needed to digest food and absorb the nutrients from food) SDE = 10% of BMR

Nutrition professionals use the following percentages to assist them in determining total kcal needed per day for individuals:

Activity metabolism (based on usual daily activities)

- Sedentary lifestyle = 20% of BMR
- Light activity lifestyle = 30% of BMR
- Moderate activity lifestyle = 40% of BMR
- Vigorous activity lifestyle = 50% of BMR
- Strenuous activity lifestyle = varies, but above 50%

Example:

Casey is twenty-three years old, 6'2" tall, and weighs 200 lbs. He is a former Marine and works out vigorously every day.

200

2.2 = 91 kg

91 kg x 1.0 (BMR factor for males) = 91 kcal BMR per hour

91 kcal x 24 = 2184 kcal needed per day Daily BMR = 2184 kcal

AM = 50% of BMR or 1092 kcal per day

SDE = 10% of BMR or 218 kcal per day

$$\text{AM} + \text{BMR} + \text{SDE} = \text{Total Energy Needs}$$

Casey's total energy needs each day at his current activity level is 3494 kcalories.

The Importance of Fiber to Digestion and Metabolism

▲ **Dietary fiber** is the term used to refer to the complex carbohydrates found in foods that cannot be digested by the stomach or small intestine. The two types of dietary fiber are soluble fiber and insoluble fiber. Soluble fiber is dissolved in water and helps control diabetes and lower blood cholesterol levels in some people. **Soluble fiber** is found in some fruits, beans, and oat bran. **Insoluble fiber** cannot be dissolved in water and therefore has different functions from soluble fiber. Insoluble fiber helps move food through the digestive tract and aids in the prevention of colon and rectal cancer, helps to control diverticulosis, and helps prevent constipation. Diverticulosis is caused when bulging pockets form on the intestinal wall and become inflamed. Sources of insoluble fiber are fruits, vegetables, wheat bran, whole wheat, and some beans.

Fiber has many functions in the body. Some of the functions of fiber include the following:

- keeps contents of the intestines moving and prevents constipation.
- helps reduce the risk of colon cancer by allowing food to pass quickly through the digestive tract. This limits susceptibility to agents in food that might cause cancer.
- helps lower the level of total blood cholesterol by lowering the LDL or "bad" cholesterol. High fiber diets are generally low-fat; both of these factors contribute to reducing the risk of heart disease.
- stimulates muscles of the digestive track. Well-toned digestive track muscles aid in prevention of diverticulosis and hemorrhoids.
- helps to control the level of blood sugars. Soluble fibers may help to lower blood sugar levels in some individuals with diabetes and therefore reduce the need for insulin or other medications.
- absorbs water and gives a feeling of fullness. This helps people feel full longer, contributing to healthy eating and weight control.

The United States Departments of Agriculture and Health and Human Services adopted a set of seven guidelines to help Americans choose a healthy diet. These guidelines, *Nutrition and Your Health: Dietary Guidelines for Americans*, address some of the problems with the diets of many Americans. The guidelines recommend a diet with plenty of grain products, vegetables, and fruits, all fiber-rich foods.

Fiber in Your Diet

◆ Match the benefit of the dietary fiber provided in the second column with the correct health problem in the first column by writing the correct letter in the blank space at the left. Each letter may be used only once.

- _____ 1. appendicitis
- _____ 2. cardiovascular disease
- _____ 3. cholesterol
- _____ 4. colon and rectal cancer
- _____ 5. constipation
- _____ 6. diabetes
- _____ 7. diarrhea
- _____ 8. diverticulosis
- _____ 9. hemorrhoids
- _____ 10. weight control

- A. Some fibers attract water in the digestive tract and soften the stool.
- B. Some fibers form a gel, helping to solidify water stools.
- C. Softer stools ease elimination for rectal muscles, and reduced pressure prevents rectal veins from swelling.
- D. Fiber exercises the muscles of the digestive tract, preventing weak areas in the large intestine thus keeping muscles from bulging out into pouches.
- E. Soluble fiber in oat bran and dried beans as well as pectin and guar from fiber foods helps reduce blood _____.
- F. Prevents compaction of intestinal contents, preventing obstruction and inflammation.
- G. Shortens transit time which prevents exposure to cancer-causing agents.
- H. Fiber binds with bile and cholesterol and all are carried out with feces.
- I. Promotes a feeling of fullness and helps control appetite.
- J. Monosaccharides combine with fiber and produce a more even rise in blood glucose.

◆ Using the chart below to choose your high-fiber foods, plan a day's menu which would provide approximately 25 grams of fiber. Be sure to include foods from all of the food groups.

Food Group & Foods	Serving	Grams of Dietary Fiber
Breads & Cereals		
All bran cereal	1/3 cup	8.5
Bran muffin	1	4.0
Corn bran cereal	2/3 cup	5.4
Oatmeal, cooked	1 cup	2.2
Whole wheat bread	1 slice	1.4
Legumes		
Kidney beans	1/2 cup	7.5
Pinto beans	1/2 cup	8.9
Vegetables		
Broccoli	1/2 cup	2.2
Corn, sweet, cooked	1/2 cup	4.7
Green peas	1/2 cup	3.6
Potatoes, with skin	1 medium	2.5
Spinach, cooked	1/2 cup	6.5
Fruits		
Apple	1 medium	3.5
Banana	1 medium	2.4
Orange	1 medium	2.6
Raisins	1/4 cup	3.1

Planning Diets for Long Term Health and Wellness

Directions: Complete the chart below based on your analysis of the School Lunch and School Breakfast menus provided by your teacher. An example is shown for you.

Factors	Needs	Nutritional Adequacy of Many Items	Menu Modifications or Dietary Needs from Other Food Sources
Life Span Stage (Adolescence)	Increased need for foods rich in calcium, protein, iron, magnesium, and the B vitamins		
Activity Level	Light:		
	Moderate:		
	Vigorous:		
Culture (those in our community)			
Gender	Males:		
	Females:		

Menu-Planning Scenarios

Case Study #1

Mr. and Mrs. Marquez are in their late seventies. Mr. Marquez is retired from the postal service. Mrs. Marquez enjoys cooking the traditional Mexican foods that she and her husband love to eat. They are very active and enjoy walking two miles everyday. Mr. Marquez' doctor has him on a diet to lose about twenty pounds.

Case Study #2

Alicia is a single, working mother with two children, ages four and ten. Both children are boys and like to play sports. The family is on a limited budget.

Case Study #3

Mr. and Mrs. Xu are a dual-income couple with two teenagers, William and Mia. William is an avid runner and a member of the swimming team. Mia plays tennis and has a part-time job on the weekends at the movie theater.

Case Study #4

Micah and Jana are expecting their first baby in about three months. Both are in their early twenties and work at the same business. Micah's job requires strenuous exercise. Jana's job is mostly sedentary.

Case Study #5

Hannah and Nat are in their early thirties and recently adopted a baby girl who is five months old. Hannah has decided to stay at home with the baby for a couple of years. In the past, she has been an elementary school teacher. Nat is a junior high science teacher.

Project: The Relationship of Diet to Treatment of Disease

1. Topic:
2. Web sites visited (give name and Web address):
3. Describe the types of information available on each Web site.
4. Write five important points you learned about this topic:
 -
 -
 -
 -
 -
5. If dietary habits are related to prevention of this disease or disorder, how can it be prevented?
6. Write an example of a therapeutic diet for individuals with this condition.

EATING DISORDERS

Definitions

Anorexia Nervosa is an eating disorder characterized by an obsessive and compelling desire to be thin.

Bulimia nervosa is characterized by binge eating and self-induced vomiting. A person with bulimia may use laxatives to rid his or her body of what is thought to be harmful.

Binge eating is an eating disorder that is characterized by the overindulgence of food without control or rational judgment about the amount being consumed.

Damaging Effects of Bulimia Nervosa

- Damage to the esophagus
- Abnormal heart rhythms which can lead to sudden death
- Injury to the kidneys
- Bladder and kidney infections, often causing kidney failure
- Lacerations or tears to the stomach, caused by excessive vomiting
- Deterioration of tooth enamel
- Malnutrition

Physical Symptoms of Anorexia Nervosa

- Deterioration of the body; especially muscle tissue
- Menstruation stops in females; impotency occurs in males
- Skin assumes dry, yellowish tint
- Low blood pressure
- Heart function inefficient due to the effect of starvation on hormones that regulate blood pressure
- Excessive hair growth on the body (possibly for warmth)
- Anemia & other signs of malnutrition
- Interrupted sleep patterns

Causes of Eating Disorders

Most scientific evidence suggests that there is a connection between biological and psychological factors that cause anorexia nervosa.

Dieting appears to trigger a process that progresses to self-starvation. The personality of the person who develops anorexia is generally conscientious, achievement oriented, and a perfectionist.

Bulimia nervosa almost exclusively affects young women and appears to be increasing in prevalence. This disorder occurs primarily in societies that place a high value on slimness.

Bulimia patients often suffer from depression and are four to five times likely to be chemically dependent.

Treatment for Eating Disorders

- Medical personnel are involved in the diagnosis and treatment of the medical complications that arise from prolonged starvation.
- Psychiatric or psychological personnel are involved in treating the self-defeating behaviors that reinforce severe eating disorders.
- Dietitians are involved in providing nutrition counseling for the patient to help with weight gain and the return to normal eating patterns.

One-Day Menu for a Pregnant Woman

Directions: Use the handouts, *Food Guide Pyramid*, *Dietary Reference Intakes*, *Recommended Dietary Allowances*, and *Food Composition Table*. Find foods on the Food Composition Table that meet the requirements for a pregnant woman, and represent your ideas on the menu below. List the amounts of the particular nutrients found in each food item and then total them to find if you have adequately planned meals to meet the nutritional needs for one day.

	Protein	Folate	Vitamin B ₁₂	Calcium	Phosphorus	Magnesium	Iron
Breakfast							
Snack							
Lunch							
Snack							
Dinner							
Snack							
Total							
Nutrient RDA's							

FOOD AND NUTRITION BOARD, NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL
RECOMMENDED DIETARY ALLOWANCES,^a Revised 1989 (Abridged)
Designed for the maintenance of good nutrition of practically all healthy people in the United States

Category	Age (years) or Condition	Weight ^b		Height ^b		Protein (g)	Vitamin A (μ g RE) ^c	Vitamin E (mg α -TE) ^d	Vitamin K (μ g)	Vitamin C (mg)	Iron (mg)	Zinc (mg)	Iodine (μ g)	Selenium (μ g)
		(kg)	(lb)	(cm)	(in)									
Infants	0-0.5	6	13	60	24	13	375	3	5	30	6	5	40	10
	0.5-1.0	9	20	71	28	14	375	4	10	35	10	5	50	15
Children	1-3	13	29	90	35	16	400	6	15	40	10	10	70	20
	4-6	20	44	112	44	24	500	7	20	45	10	10	90	20
	7-10	28	62	132	52	28	700	7	30	45	10	10	120	30
	11-14	45	99	157	62	45	1,000	10	45	50	12	15	150	40
Males	15-18	66	145	176	69	59	1,000	10	65	60	12	15	150	50
	19-24	72	160	177	70	58	1,000	10	70	60	10	15	150	70
	25-50	79	174	176	70	63	1,000	10	80	60	10	15	150	70
	51+	77	170	173	68	63	1,000	10	80	60	10	15	150	70
	11-14	46	101	157	62	46	800	8	45	50	15	12	150	45
	15-18	55	120	163	64	44	800	8	55	60	15	12	150	50
Females	19-24	58	128	164	65	46	800	8	60	60	15	12	150	55
	25-50	63	138	163	64	50	800	8	65	60	15	12	150	55
	51+	65	143	160	63	50	800	8	65	60	10	12	150	55
	Pregnant					60	800	10	65	70	30	15	175	65
Lactating	1st 6 months					65	1,300	12	65	95	15	19	200	75
	2nd 6 months					62	1,200	11	65	90	15	16	200	75

NOTE: This table does not include nutrients for which Dietary Reference Intakes have recently been established (see *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride* [1997] and *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B₆, Folate, Vitamin B₁₂, Pantothenic Acid, Biotin, and Choline* [1998]).

^a The allowances, expressed as average daily intakes over time, are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses.

Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined.

^b Weights and heights of Reference Adults are actual medians for the U.S. population of the designated age, as reported by NHANES II. The median weights and heights of those under 19 years of age were taken from Hamill et al. (1979). The use of these figures does not imply that the height-to-weight ratios are ideal.

^c Retinol equivalents. 1 retinol equivalent = 1 μ g retinol or 6 μ g β -carotene.

^d α -Tocopherol equivalents. 1 mg d- α tocopherol = 1 α -TE.

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FOOD AND NUTRITION BOARD, INSTITUTE OF MEDICINE-NATIONAL ACADEMY OF SCIENCES
DIETARY REFERENCE INTAKES: RECOMMENDED INTAKES FOR INDIVIDUALS

Life-Stage Group	Calcium (mg/d)	Phosphorus (mg/d)	Magnesium (mg/d)	Vitamin D (μg/d) ^{a,b}	Fluoride (mg/d)	Thiamin (mg/d)	Riboflavin (mg/d)	Niacin (mg/d) ^c	Vitamin B ₆ (mg/d)	Folate (μg/d) ^d	Vitamin B ₁₂ (μg/d)	Pantothenic Acid (mg/d)	Biotin (μg/d)	Choline ^e (mg/d)
Infants														
0-6 mo	210*	100*	30*	5*	0.01*	0.2*	0.3*	2*	0.1*	65*	0.4*	1.7*	5*	125*
7-12 mo	270*	275*	75*	5*	0.5*	0.3*	0.4*	4*	0.3*	80*	0.5*	1.8*	6*	150*
Children														
1-3 yr	500*	460	80	5*	0.7*	0.5	0.5	6	0.5	150	0.9	2*	8*	200*
4-8 yr	800*	500	130	5*	1*	0.6	0.6	8	0.6	200	1.2	3*	12*	250*
Males														
9-13 yr	1,300*	1,250	240	5*	2*	0.9	0.9	12	1.0	300	1.8	4*	20*	375*
14-18 yr	1,300*	1,250	410	5*	3*	1.2	1.3	16	1.3	400	2.4	5*	25*	550*
19-30 yr	1,000*	700	400	5*	4*	1.2	1.3	16	1.3	400	2.4	5*	30*	550*
31-50 yr	1,000*	700	420	5*	4*	1.2	1.3	16	1.3	400	2.4	5*	30*	550*
51-70 yr	1,200*	700	420	10*	4*	1.2	1.3	16	1.7	400	2.4 ^f	5*	30*	550*
> 70 yr	1,200*	700	420	15*	4*	1.2	1.3	16	1.7	400	2.4 ^f	5*	30*	550*
Females														
9-13 yr	1,300*	1,250	240	5*	2*	0.9	0.9	12	1.0	300	1.8	4*	20*	375*
14-18 yr	1,300*	1,250	360	5*	3*	1.0	1.0	14	1.2	400 ^g	2.4	5*	25*	400*
19-30 yr	1,000*	700	310	5*	3*	1.1	1.1	14	1.3	400 ^g	2.4	5*	30*	425*
31-50 yr	1,000*	700	320	5*	3*	1.1	1.1	14	1.3	400 ^g	2.4	5*	30*	425*
51-70 yr	1,200*	700	320	10*	3*	1.1	1.1	14	1.5	400	2.4 ^f	5*	30*	425*
> 70 yr	1,200*	700	320	15*	3*	1.1	1.1	14	1.5	400	2.4 ^f	5*	30*	425*
Pregnancy														
≤ 18 yr	1,300*	1,250	400	5*	3*	1.4	1.4	18	1.9	600 ^h	2.6	6*	30*	450*
19-30 yr	1,000*	700	350	5*	3*	1.4	1.4	18	1.9	600 ^h	2.6	6*	30*	450*
31-50 yr	1,000*	700	360	5*	3*	1.4	1.4	18	1.9	600 ^h	2.6	6*	30*	450*
Lactation														
≤ 18 yr	1,300*	1,250	360	5*	3*	1.5	1.6	17	2.0	500	2.8	7*	35*	550*
19-30 yr	1,000*	700	310	5*	3*	1.5	1.6	17	2.0	500	2.8	7*	35*	550*
31-50 yr	1,000*	700	320	5*	3*	1.5	1.6	17	2.0	500	2.8	7*	35*	550*

NOTE: This table presents Recommended Dietary Allowances (RDAs) in bold type and Adequate Intakes (AIs) in ordinary type followed by an asterisk (*). RDAs and AIs may both be used as goals for individual intake. RDAs are set to meet the needs of almost all (97 to 98 percent) individuals in a group. For healthy breastfed infants, the AI is the mean intake. The AI for other life-stage and gender groups is believed to cover needs of all individuals in the group, but lack of data or uncertainty in the data prevent being able to specify with confidence the percentage of individuals covered by this intake.

^a As cholecalciferol. 1 μg cholecalciferol = 40 IU vitamin D.

^b In the absence of adequate exposure to sunlight.

^c As niacin equivalents (NE). 1 mg of niacin = 60 mg of tryptophan, 0-6 months = preformed niacin (not NE).

^d As dietary folate equivalents (DFE). 1 DFE = 1 μg food folate = 0.6 μg of folic acid (from fortified food or supplement) consumed with food = 0.5 μg of synthetic (supplemental) folic acid taken on an empty stomach.

^e Although AIs have been set for choline, there are few data to assess whether a dietary supply of choline is needed at all stages of the life cycle, and it may be that the choline requirement can be met by endogenous synthesis at some of these stages.

^f Because 10 to 30 percent of older people may malabsorb food-bound B₁₂, it is advisable for those older than 50 years to meet their RDA mainly by consuming foods fortified with B₁₂ or a supplement containing B₁₂.

^g In view of evidence linking folate intake with neural tube defects in the fetus, it is recommended that all women capable of becoming pregnant consume 400 μg of synthetic folic acid from fortified foods and/or supplements in addition to intake of food folate from a varied diet.

^h It is assumed that women will continue consuming 400 μg of folic acid until their pregnancy is confirmed and they enter prenatal care, which ordinarily occurs after the end of the periconceptional period—the critical time for formation of the neural tube.

Food Composition Table

FOODS	WT (g)	KCAL	PRO (g)	CHO (g)	FAT (g)	PUFA (g)	SFA (g)	CHOL (mg)	A (RE)	C (mg)	B-1 (mg)	B-2 (mg)	HA (mg)	Ca (mg)	Fe (mg)	Na (mg)
Vegetables																
Broccoli, frozen, chopped 1/2 cup	92	25	2.9	4.9	0.1	0.1	0	0	174	37	0.05	0.08	0.4	47	0.56	22
Carrots, canned, 1/2 cup slices	73	17	0.5	4	0.1	0.1	0	0	1006	2	0.01	0.02	0.4	10	0.47	176
Green beans, canned, 1/2 cup	88	13	0.8	3.1	0.1	0	0	0	24	3	0.01	0.04	0.1	18	0.61	170
Lettuce salad, 1/2 cup shredded	28	5	0.4	1	0.1	0	0	0	53	5	0.01	0.02	0.1	19	0.39	3
Potatoes, hash brown, homemade 1/2 cup	78	163	1.9	16.6	10.9	1.3	4.2	*	*	5	0.06	0.02	1.6	6	0.63	19
Spinach, 1/2 cup boiled	90	21	2.7	3.4	0.2	0.1	0	0	737	9	0.09	0.21	0.44	122	3.21	63
Tomato, 1 raw	123	24	1.1	5.3	0.3	0.1	0	0	139	22	0.07	0.06	0.7	8	0.59	10
Fruits																
Apple, raw w/ skin 1 med.	138	81	0.3	21.1	0.5	0.1	0.1	0	7	8	0.02	0.02	0.1	10	0.25	1
Apricots, raw 3 med.	106	51	1.5	11.8	0.4	0.1	0	0	277	11	0.03	0.04	0.6	16	0.58	1
Banana, raw 1 med.	114	105	1.2	26.7	0.6	0.1	0.2	0	9	10	0.05	0.11	0.6	7	0.35	1
Grapes, raw 1 cup	92	58	0.6	15.8	0.3	0.1	0.1	0	9	4	0.09	0.05	0.3	13	0.27	2
Kiwi, raw 1 med.	78	46	0.8	11.3	0.3	*	*	*	13	75	0.02	0.04	0.4	20	0.31	4
Orange, raw 1 med.	140	65	1.4	16.3	0.1	0	0	0	26	80	0.12	0.06	0.4	56	0.17	1
Orange juice, from concentrate, 8 fl. oz.	249	112	1.7	26.8	0.1	0	0	0	19	97	0.20	0.05	0.5	22	0.24	2
Orange juice, fresh, 8 fl. oz.	248	111	1.7	25.8	0.5	0.1	0.1	0	50	124	0.22	0.07	0.1	27	0.50	2
Peach, raw 1 med.	87	37	0.6	9.7	0.1	0	0	0	47	6	0.02	0.04	0.9	5	0.10	0
Pear, canned light syrup, 1 cup	251	144	0.5	38.1	0.1	0	0	0	0	2	0.03	0.04	0.4	13	0.70	13
Plum, raw 1 med.	66	36	0.5	8.6	0.4	0.1	0	0	21	6	0.03	0.06	0.3	2	0.07	0
Prune juice, 8 fl. oz.	256	181	1.6	44.7	0.1	0	0	0	1	11	0.04	0.18	2	30	3.03	11
Raisins, seedless 2/3 cup	100	300	3.2	79.1	0.5	0.1	0.2	0	1	3	0.16	0.09	0.8	49	2.08	12
Strawberries, raw, 1 cup	149	45	0.9	10.5	0.6	0.3	0	0	4	85	0.03	0.10	0.3	21	0.57	2
Breads and Cereals, Rice, and Pasta																
Bran flakes, 3/4 cup 1 oz.	28	93	3.6	22.2	0.5	*	*	*	375	*	0.40	0.40	5	14	8.10	264
Macaroni, enriched, cooked 1 cup	140	159	5.2	33.7	0.7	*	*	0	*	0	0.20	0.11	1.5	11	2.25	1
Oatmeal, quick, old fashioned, 1/3 cup dry	28	109	4.6	18.4	1.9	*	*	*	*	*	0.19	0.03	0.2	14	1.08	1
Oatmeal, w/ raisins and spice 1 pkg. prep.	158	161	4.3	31.8	1.8	*	*	*	440	*	0.51	0.36	5.5	165	6.58	225
Popcorn, air popped, 1 cup	6	23	0.8	4.6	0.3	*	0	*	*	1	*	0.01	0.1	1	0.20	0
Popcorn, w/ fat and salt, 1 cup	9	41	0.9	5.3	2	*	0.9	*	*	0	*	0.01	0.2	1	0.20	175
Pretzels, 1 oz.	28	111	2.6	22.4	1	*	*	*	*	0	0.09	0.07	1.2	7	0.55	451
Rice, white enriched, cooked, 1/2 cup	80	85	2	19	0	0	0	0	0	0	0	0	1	22	0.70	0
Rolls, dinner/pan 1 roll	28	85	2.4	14	2.1	*	*	*	*	0	0.14	0.09	1.1	33	0.83	155
Wheat bread, 1 slice	24	61	2.3	11.3	1	*	*	0	*	0	0.11	0.08	1.1	30	0.84	129
White bread, 1 slice	24	64	2	11.7	0.9	*	*	*	*	0	0.11	0.07	0.9	30	0.68	123
Whole wheat bread, 1 slice	25	61	2.4	11.4	1.1	*	*	*	*	0	0.09	0.05	1	18	0.86	159

Food Composition Table, Cont'd.

FOODS	WT (g)	KCAL	PRO (g)	CHO (g)	FAT (g)	PUFA (g)	SFA (g)	CHOL (mg)	A (RE)	C (mg)	B-1 (mg)	B-2 (mg)	NIA (mg)	Ca (mg)	Fe (mg)	Na (mg)
Milk, Yogurt, and Cheese																
Lowfat milk 2% fat, 8 fl. oz.	244	121	8.1	11.7	4.7	0.2	2.9	18	140	2	10	40	0.2	297	122	122
Skim milk, 8 fl. oz.	245	86	8.4	11.9	0.4	0	0.3	4	149	2	09	34	0.2	302	0.10	126
Skim (nontat dry) milk 8 fl. oz.	245	90	8.8	12.3	0.6	0	0.4	5	149	2	10	43	0.2	316	0.12	130
Whole milk, 3.3% fat 8 fl. oz.	227	150	8.0	11.4	8.2	0.3	5.1	33	76	2	09	40	0.2	291	0.12	120
Lowfat yogurt 8 fl. oz.	227	144	11.9	16	3.5	0.1	2.3	14	36	2	10	49	0.3	415	0.18	159
Fruit flavor yogurt 8 fl. oz.	28	225	9.0	42.3	2.6	0.1	1.7	10	27	1	08	37	0.2	314	0.14	121
American, processed cheese 1 oz.	28	106	6.3	0.5	8.9	0.3	5.6	27	82	0	01	10	0	124	0.11	406
Cheddar cheese, 1 oz.	28	114	7.1	0.4	9.4	0.3	6.0	30	86	0	01	11	0	204	0.19	176
Monterey cheese, 1 oz.	28	106	6.9	0.2	8.6	*	*	*	*	0	*	11	*	212	0.20	152
Mozzarella cheese, 1 oz.	28	79	7.8	0.9	4.9	0.1	3.1	15	54	0	01	10	0	207	0.07	150
Swiss cheese, 1 oz.	28	107	8.1	1	7.8	0.3	5	26	72	0	01	10	0	272	0.05	74
Ice cream, vanilla 10% fat 1 cup	133	269	4.8	31.7	14.3	0.5	8.9	59	133	1	05	33	0.1	176	0.12	116
Meat, Poultry, Fish, Dry Beans and Peas, Eggs, Nuts and Seeds																
Bacon, cured, 3 med. pieces	19	109	5.8	0.1	9.4	1.1	3.3	16	0	6	0.13	0.05	1.4	2	0.31	303
Beef, ground, baked well done 3.5 oz.	100	274	30.3	0	16	0.6	6.3	107	*	0	0.05	0.31	5.4	9	2.96	64
Beef and vegetable stew, 1 cup	245	218	15.7	15.2	10.5	*	4.9	*	*	17	0.15	0.17	4.7	29	2.90	91
Chicken, light meat w/o skin, roasted	100	173	30.9	0	4.5	1	1.3	85	9	0	0.07	0.12	12.4	15	1.06	77
Egg, 1 large fried	46	83	5.4	0.5	6.4	0.7	2.4	246	83	0	0.03	0.13	0	26	0.92	144
Peanut butter, 1 Tbsp.	16	95	4.6	2.2	8.2	2.5	1.7	0	*	*	0.01	0.01	1.9	5	0.30	75
Peanuts, dry roasted 1 oz.	28	164	6.6	6.0	13.9	4.4	1.9	0	0	0	0.12	0.03	3.8	15	0.63	228
Peanuts, oil roasted 1 oz.	28	165	7.6	5.3	14	4.4	1.9	0	0	0	0.08	0.03	4.2	24	0.54	4
Pinto beans, 1 cup boiled	171	235	14	43.9	0.9	0.3	0.2	0	0	4	0.32	0.16	0.7	82	4.47	3
Pork chops w/brown gravy 6.5 oz. entree	184	252	27.1	4.4	16.2	*	*	*	*	1	0.43	0.20	4.3	9	2.50	367
Sausage, fresh 1 link	13	48	2.6	0.1	4.1	0.5	1.4	11	*	0	0.10	0.03	0.6	4	0.16	168
Sunflower seeds, 1 oz.	28	165	5.5	6.8	14.1	9.3	1.5	0	*	*	0.03	0.07	2	20	1.1	1
Fast Foods																
Cheeseburger, 1 reg. sandwich	112	299	14.8	28.3	15.1	*	*	45	*	1	0.26	0.24	3.7	136	2.33	672
French fries, 3 oz.	85	274	3.4	33.1	14.2	*	*	14	*	5	0.11	0.03	1.8	14	0.71	30
Hamburger, w/ 4 oz. meat	174	444	24.9	37.6	21.1	*	*	71	*	2	0.38	0.38	7.8	75	4.84	762
Pizza, cheese 1 slice	120	290	14.6	39.1	8.6	*	*	56	*	2	0.34	0.29	4.2	220	1.61	698
Pizza, pepperoni 1 slice	120	306	13	36.7	11.5	*	*	*	*	2	0.32	0.29	5.1	196	2.52	817

Food Composition Table, Cont'd.

FOODS	WT (g)	KCAL	PRO (g)	CHO (g)	FAT (g)	PUFA (g)	SFA (g)	CHOL (mg)	A (RE)	C (mg)	B-1 (mg)	B-2 (mg)	NIA (mg)	Ca (mg)	Fe (mg)	Na (mg)
Miscellaneous																
Cola, 12 fl. oz.	370	151	0.1	38.5	0.1	*	*	0	0	0	0	0	0	9	0.13	14
Cola, diet, 12 fl. oz.	355	2	0.2	0.3	0	0	0	0	0	0	0.02	0.08	0	12	0.11	21
Orange soda, 12 fl. oz.	372	179	0	45.8	0	*	*	0	*	0	0	0	0	15	0.26	52
Milk choc. bar, 1.65 oz.	47	254	3.8	27.1	14.5	*	*	*	*	*	0.04	0.17	0.2	94	0.52	35
Milk choc. w/ almonds	28	151	2.6	14.5	10.1	*	4.5	*	*	0	0.02	0.12	0.2	85	0.50	23
Peanut butter and choc. bar, 2 oz.	57	260	4	38	12	*	*	*	*	*	*	*	*	*	*	100
Peanut bar, 1.6 oz.	45	240	8	21	14	*	*	*	*	*	*	*	*	*	*	110
Bite-size fruit snacks, 1 pouch	26	100	1	21	2	*	*	*	*	*	*	*	*	*	*	105
Corn chips, 1 oz.	28	153	1.7	16.6	8.8	*	*	*	*	0	0.05	0.3	0	2	*	218
Potato chips, 1 oz.	28	148	1.8	14.7	10.1	5.2	2.6	0	0	12	0.04	0.01	1.2	7	0.34	133
Tortilla chips, reg. or nacho 1 oz.	28	150	2	18	8	*	*	*	*	*	*	*	*	*	*	155
Brownie w/nuts—homemade 1 brownie	20	97	1.3	10.2	6.3	*	1.4	*	*	0	0.04	0.02	0.1	8	0.40	50
Cake, devil's food—homemade 1 piece	60	227	3.4	30.4	11.3	*	*	*	*	0	0.08	0.11	0.7	68	1.03	160
Doughnuts, yeast, 1 doughnut	42	176	2.7	16	11.3	*	2.8	*	*	0	0.07	0.07	0.8	16	0.60	99
Pie, cherry—homemade, 1/8 pie	118	308	3.1	45.3	13.3	*	3.5	*	*	0	0.02	0.02	0.8	17	0.40	359
Margarine, soft 1 Tbsp.	*	100	0	0	11	4	2	0	*	*	*	*	*	*	*	95
Molasses, blackstrap, 1 Tbsp.	20	43	0	11	0	0	0	*	*	*	0.02	0.04	0.4	137	3.20	19
Salad dressing—thousand island, 1 Tbsp.	16	59	0.1	2.4	5.6	3.1	0.9	*	50	*	*	*	*	2	0.10	109
Sugar, white granulated, 1 tsp.	4	15	0	4	0	0	0	*	*	0	0	0	0	0	0	0

Sources: USDA Food Handbooks

*Denotes "information not available." Do not assume that the value would be zero.

The nutrient data provided in the Food Composition Table should be seen only as an approximation and used strictly as a guide in learning activities.

The many factors which affect the amounts of nutrients in foods include:

- animal diets
- mineral content of soil
- types of fertilizer used on samples
- season of the year
- method of storage
- length of storage

- processing methods
- methods of analysis
- moisture content of analyzed samples
- method of food preparation

Therefore, many different nutrient values will be reported in a variety of reliable resources.

L WT=weight
E KCAL=calories
G PRO=protein
E CHO=carbohydrate
N FAT=fat
D PUFA=polyunsaturated fatty acids
 SFA=saturated fatty acids
 CHOL=cholesterol
 A(RE)=vitamin A (retinol equivalent)
 C=vitamin C (ascorbic acid)
 B-1=vitamin B-1 (thiamin)
 B-2=vitamin B-2 (riboflavin)
 NIA=niacin
 Ca=calcium
 Fe=iron
 Na=sodium

Food Recall Form

Directions: Write down everything you eat and drink for three days. Write the quantity of the food or beverage, also. For example: 1 c. Crispy Cereal

1 c. 2 percent milk

1 small glass apple juice

	Day 1	Day 2	Day 3
Breakfast			
Morning Snack			
Lunch			
Afternoon Snack			
Dinner			
Evening Snack			

Activity Assessment

Activity:

Criteria	3	2	1
Depth and breadth of research	offers accurate analysis of the major and minor issues surrounding the topic; uses three or more references	relates major facts to the basic topic with fair degree of accuracy; uses two references	provides only minor facts basic to the topic; inaccuracies; uses only provided information (text) as reference
Application of knowledge	demonstrates in-depth understanding of the topic; accurately employs all parts of the information	demonstrates general understanding of the topic; employs most parts of the information with fair degree of accuracy	lacks understanding of topic; employs only the most basic parts of the information; several misconceptions about the topic
Written/Oral communication	presents a well organized presentation; message is easily understood	presents a somewhat organized presentation; message is vague	presentation is unorganized; message tends to wander or ramble and hard to understand
Creativity	imaginative, self-initiated finding and use of resources; extensive originality in presentation	considers provided materials; demonstrates adequate originality in presentation	lacks initiative when finding and using resources; lacks originality in presentation

Self-Reflection: On the back of this sheet, write a paragraph that describes how you can use knowledge gained from this activity in the future.

Adapted from Family and Consumer Sciences Education Association (1994). *How do we know they know?* Publication# A261-08482 ISBN 0-911365-35-4 — Copies Available: FCSFA, Central Washington University, 400 E 8th Avenue, Ellensburg, WA 98926.

Criteria for Determining the Reliability of Nutrition Information

- Did the author receive nutrition training and/or degrees from a recognized university?
 - What type of experience has the author had, and is the author presently working with a reliable nutrition agency or institution?
 - Do professional medical societies or professional nutritionists endorse the article or book?
 - Did the author list footnotes listing nutrition or medical books and journals?
 - Is the book or article included on the list of a professional group, such as the national, state, or local cancer, heart, or dietetic association?
 - Is the information consistent with basic concepts of nutrition and health or does it claim to cure medical conditions or exaggerate virtues of individual foods, nutrients, or supplements?
-

The Truth of the Matter

Directions: Complete the following questions using a magazine or newspaper article on nutrition, a nutrition-related book, or an article from nutrition or medical journals.

1. What is the author's name?
2. From what university or institution did the author receive training?
3. In what subject was his or her training?
4. With whom is the author associated at the present time?
5. List the professionals who have endorsed the article or book.
6. List any names of nutrition experts from whom the author received advice or assistance.
7. Give examples of the footnotes listing reliable nutrition or medical books.
8. Is the book on the acceptable list of a professional group, such as the American Heart Association or the American Cancer Society?
9. Does the article make claims to cure medical conditions or is the information consistent with the basic concepts of nutrition and health?
10. Write a brief synopsis of an article or a portion of a book.
11. Nutrition articles are included in many newspapers and household magazines. Often there is very little information given about the author of these articles. How can you determine if this information is reliable?

Food Processing Methods

Food processing includes all the methods of preparing foods so that it is readily available to be used by the consumer. Food processing includes the washing, trimming, and storing of fresh produce and the highly efficient methods of food preservation used by the food industry today. It is food processing that enables cattle, wheat, and sugar cane to become steak, milk, flour, and sugar.

Food processing methods involve two areas:

- the methods involved in the preservation of food
- the methods of preparation that make the food suitable for use.

Basic Principles and Effects of Food Processing Methods		
Process	Principle of Preservation	Effects on Food
Chemical (additives)	The growth of microorganisms is inhibited.	Quality, taste, texture, and color are retained. The function of ingredients is improved.
Curing (pickling, salting, sugaring)	The addition of acids lowers pH levels, which inhibits microbial growth. Salt and sugar inhibit microbial growth by decreasing the availability of water.	Shelf life is extended. Texture and color may be affected.
Drying/Dehydration	The water that microorganisms need for growth is removed.	Flavor and appearance are affected. Some nutrients are lost. Shelf life is extended.
Fermentation	The acidity of the culture lowers pH levels, therefore reducing growth of microorganisms.	Flavor and appearance may be affected. Shelf life is extended.
Freezing	Low temperatures convert water to ice, which makes water unavailable to microorganisms for growth. It reduces enzymatic changes.	Texture may be affected, but color, flavor, and nutrients are retained.
Freeze-drying	A process called sublimation is used. Foods are frozen, then heated just below the melting point, which allows the ice to vaporize without becoming a liquid.	Foods retain original flavor, texture, and nutrient content better than foods dried by other methods. Foods rehydrate very easily.
Heat Sterilization (canning)	Harmful microorganisms are destroyed. Enzymatic changes are reduced.	Some loss of heat-sensitive nutrients and water-soluble vitamins may occur. Flavor, texture, and color may change slightly. Lengthy shelf life stability is provided.

Food Processing Methods, Cont'd.

Basic Principles and Effects of Food Processing Methods, cont'd.		
Process	Principle of Preservation	Effects on Food
Irradiation	Beta or gamma rays are used to destroy harmful microorganisms.	Chemical reactions may affect flavor, color, or texture. Extended shelf life is provided.
Other Heat Sterilization Methods (Pasteurization, Smoking, Aseptic packaging)	Harmful microorganisms are destroyed.	Heat-sensitive nutrients are lost. Shelf life is extended.
Refrigeration	Growth of microorganisms is slowed down or stopped by the low temperatures.	Flavor, color, and texture is retained, but the shelf life is very short. After periods of time, microbial growth can occur.

Functions of Food Additives

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⇒ Appearance and Taste

The coloring agents, flavorings, flavor enhancers, and sweeteners improve taste and appearance.

⇒ Freshness

Preservatives prevent rancidity (spoilage) of fats, help retain natural color in foods, and retard spoilage.

⇒ Nutritional Content

Food additives improve the nutritional value of some foods through fortification and enrichment of important vitamins and minerals.

⇒ Processing and Manufacturing

Food additives, such as stabilizers, thickeners, texturizers, and emulsifiers, enable consumers to have convenient food products that blend, mix, and bake successfully with the body and texture that is desired.

.....

Intentional Food Additives

Additive	Description
Anticaking Agents	Prevent lumping or caking of a finely powdered substance
Antioxidants	Delay or prevent food products from turning rancid or browning
Colors	Give an appetizing or characteristic color to foods and increase product acceptance
Emulsifiers	Help to evenly distribute tiny particles of one liquid into another and improve the consistency, stability, and texture of food products
Flavor Enhancers	Supplement or heighten the original taste and/or aroma of food without changing or adding their own taste or aroma
Flavorings	Heighten natural flavor and/or restore flavors lost in processing
Humectants	Cause a food product to retain moisture
Leavening Agents	Affect cooking results, texture, and volume of food products
Maturing and Bleaching Agents; Dough Conditioners	Accelerate the aging process of the food product as well as improve its baking qualities
Nutrients	Enrich (replace vitamins and minerals lost in processing) or fortify (add nutrients that may be lacking in a person's diet) a food product to maintain or improve nutritional value
pH Control Agents	Change or maintain the acidity or alkalinity in food and drink products
Preservatives	Prevent food from spoilage by bacteria, molds, fungi, and yeast; extend the shelf life and protect the natural color or flavor of a product; prevent chemical reactions that cause food to deteriorate
Stabilizers, Thickeners, Texturizers	Impart body, improve consistency or texture, stabilize emulsions, and affect how the food feels in the mouth
Sweeteners	Make the smell or taste of food more agreeable or pleasurable

GUIDELINES FOR A CLASSROOM DEBATE

Discussion, Disagreement, and Debate: What's the difference?

Discussion:

- People talking to reach conclusions, to give and receive information, or to express their ideas in an informal and unplanned manner.

Disagreement:

- A disagreement stems from a discussion when individuals' opinions, thoughts, and beliefs differ.
- Like a discussion, a disagreement is usually informal and unprepared.

Debate:

- Opposing viewpoints are presented in a balanced, well organized, and researched manner by individuals or teams to persuade others of their position.
- Participants must have evidence to support their viewpoint.
- A debate does not "prove" or "decide" an issue. The team that offers the strongest debate gives better information for their arguments and effectively addresses arguments from the opposing team.
- In a debate, teams do not "have" arguments, they "present" arguments.
- The team that is "for" the proposition is called the ***affirmative team***. The team that is "against" the proposition is called the ***negative team***.

Preparing and Conducting a Classroom Debate:

1. **Select a topic.**
2. **State a proposition.** A ***proposition*** is the statement of opinions, thoughts, or beliefs on a particular viewpoint.
3. **Select teams.** Select the affirmative and negative teams and a chairperson for each team.
4. **List arguments.** Each team should list their arguments, choose their four strongest arguments, and predict their opponent's four strongest arguments.
5. **Appoint speakers.** Team members can select speakers, or each team member can present one or more arguments.
6. **Research and prepare evidence.** Teams should research and prepare evidence supporting the arguments and prepare a summary statement. Information should not be shared with the other team.
7. **Rehearse the debate.** Teams should rehearse the debate, but the other team should not hear the rehearsal. Arguments should be covered from the least important to the most important.
8. **Conduct the debate.** Team members will state positions they feel are true and will take turns explaining why their position is right and the opponent's position is wrong. An equal number of people should speak in an established order for equal amounts of time.
9. **Present decision of audience.** An audience will listen to the debates and decide which team presented the strongest case for their team's arguments.

Compare and Contrast Types of Food Packaging

Diagram illustrating a comparison and contrast structure for food packaging types.

Top section: Two empty boxes for labels.

Middle section: A central box labeled "HOW ALIKE?" with five horizontal lines for notes.

Bottom section: Two vertical boxes labeled "HOW DIFFERENT?" with ten horizontal lines each. Five horizontal double-headed arrows connect the two vertical boxes, indicating a point-by-point comparison.

Adapted from: *Organizing Thinking*, Midwest Publications, 1990.

Types of Microorganisms

Bacteria



- Bacteria are more commonly involved in food-borne illness than are viruses, yeasts, and molds.
- Bacteria grow and multiply at room temperature, 60°F – 125°F.
- The longer food is kept at room temperature, the more bacteria will multiply.
- High temperatures will kill most microorganisms and cold temperatures keep them from multiplying.

Viruses



- Viruses cause illnesses, such as colds, influenza, and infectious hepatitis.
- Unlike bacteria, viruses cannot grow and multiply on their own but must depend on a living host to reproduce.
- For this reason, viruses do not increase in number while they are in food, they merely transport themselves into it.

Yeasts



- Yeasts are fungi that require sugar and moisture for survival.
- Yeasts often consume these ingredients in food products and spoil the food in the process.
- In general, yeast spoilage can often be recognized by the presence of bubbles and an alcoholic smell or taste.
- Yeast spoilage can create a slime on fruit juices, pickle brine, or a pink discoloration in cottage cheese.
- Yeast growth can be inhibited by proper refrigeration.

Molds



- Molds are furry-looking fungi that can grow on almost any food at almost any storage temperature, and under almost any conditions.
- Certain molds produce toxins that have been known to cause cancer in animals.
- Soft food items with mold should be discarded.
- Some molds give a musty odor and flavor to foods. Some people have developed allergies to certain molds. These allergies affect the sinuses, eyes, ears, and respiratory tract.

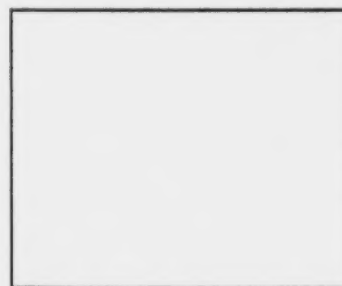
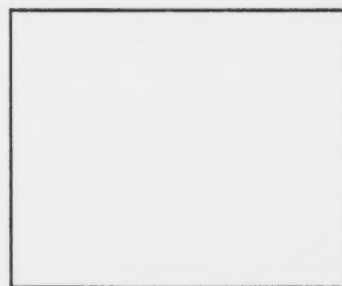
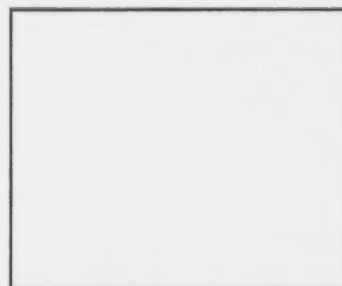
Scenarios: The Growth of Microorganisms

▲ The four types of microorganisms that affect food are bacteria, viruses, yeast, and molds. Their presence in food may or may not be harmful to humans. To avoid food-borne illness, it is wise to be careful how food is handled and to be conscious of how long and at what temperature it has been stored.

Directions: Draw the image of the microorganisms in the appropriate space. Then answer the questions regarding these microorganisms.

Scenarios:

1. Thomas has allergies. He has a runny nose and itching eyes after eating a piece of food that had a furry-looking growth on it. Which type of microorganism may have caused this reaction? What should he have done to make the food safe to eat in the first place?
2. Susan has a stomachache after eating chicken salad that sat out unrefrigerated overnight. Which type of microorganism may have caused this? What could Susan have done to prevent this illness?
3. Brian has a cold. He shared a glass of cola with his friend who was sick. Which type of microorganism may have caused this? What could he have done to prevent this illness?
4. Paula opened a carton of cottage cheese and noticed that it had pink discoloration. What type of microorganism may have caused this?



Brochure Assessment

Part A: Circle the number that indicates how effectively the brochure meets the stated criteria.

	3	2	1
Quality of Research	Accurate analysis of the research Reliable sources Three or more references used	Fair degree of accuracy Some reliability of resources Two references used	Basic information with inaccuracies Questionable reliability One reference used
	3	2	1
Application of Knowledge	Demonstrates in-depth understanding of the topic Accurately uses information in the brochure	Demonstrates general understanding of the topic Uses research information with a fair degree of accuracy in the brochure	Lacks understanding of the topic Uses only the basic parts of the information; several misconceptions
	3	2	1
Written Presentation	Well organized content Attractive, well-designed format Message is clear and easy to understand Typed or computer-formatted Strong eye appeal	Generally well-organized content Adequate design for format Message is sufficiently understood Typed or computer-formatted; adequate appeal	Unorganized content; hard to follow Unattractive format Message is difficult to understand Handwritten or type lacks neatness
	3	2	1
Creativity	Imaginative; originality demonstrated Graphics that make the work "come alive"	Adequate creativity Some use of graphics that add to the presentation	Lacks originality Few or no graphics used or graphics do not relate to text

Brochure Assessment, Cont'd.

Part B: Write a paragraph that describes how you can use the knowledge gained from this activity.

Source: Adapted from the *Alternative Assessment: A Family and Consumer Teacher's Tool Kit* (1996). Columbus, OH: The Ohio State University, Vocational Instructional Materials Laboratory. Used with permission.

Laboratory Experiment: Molds

Objective: To observe the destructive effects of mold on food products.

Experiment:

Materials:

- molded bread (allow five to six pieces of bread to mold prior to the experiment)
- carrot
- orange
- dry cereal
- toast
- cookie
- potato
- oatmeal
- cotton swabs
- resealable plastic sandwich bag

Procedure:

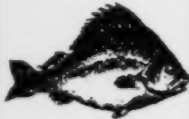
1. Place 1/4 c. water and one food sample in a plastic resealable bag.
2. Drag a cotton swab across the molded bread and then wipe the swab on each sample. Use a new swab for each food sample.
3. Seal the bags.
4. Put the bags in a dark area for three days. Wrap the molded bread in paper towels or newspaper and discard.
5. Without opening the bags, examine each food sample.
6. Note the mold growth.

Key Questions

- Did mold grow on all of the food samples?
 - Are the molds identical? Why?
7. Record your observations as directed by your teacher.
 8. Discard the resealable plastic bags without opening them as some individuals may be allergic to molds.

*Note: Variables such as the foods chosen and environmental factors, such as temperature and humidity, will affect the growth rate of the molds.

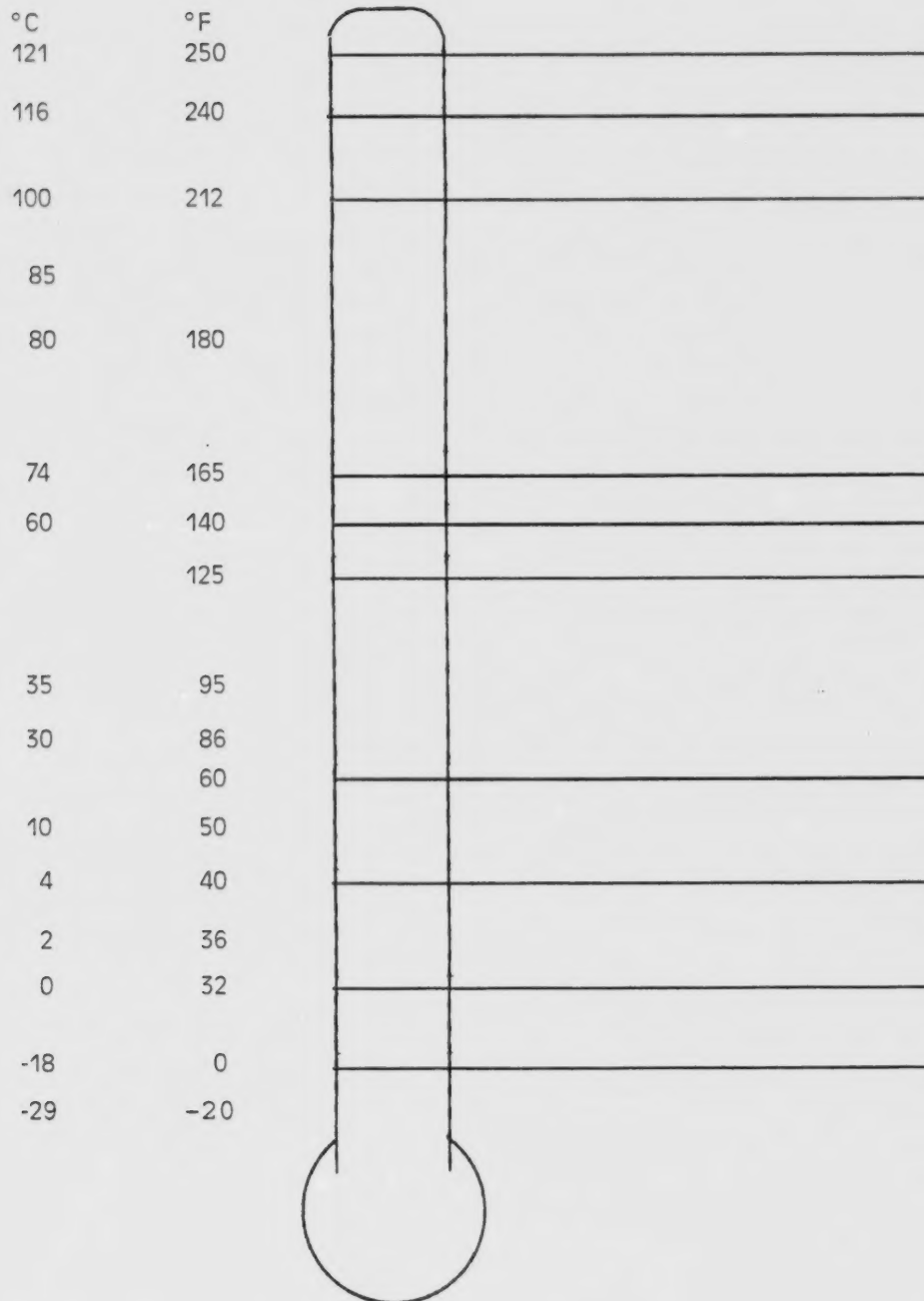
Food Storage Guidelines

Food Product	Refrigeration		Freezing		Dry Storage	
	Temperature/ Procedure	Storage Life	Temperature/ Procedure	Storage Life	Temperature/ Procedure	Storage Life
Meat (frozen or unfrozen beef, veal, or lamb) 	(unfrozen) 36°F or below Store as soon as possible. Wrap raw meat loosely.	2 or 3 days	(frozen) 0°F or below Store as soon as possible. Store in original wrapping. Wrap and seal in moisture-proof paper or containers.	up to 1 yr.	Not recommended	
Poultry (frozen or unfrozen) 	(unfrozen) 36°F or below Store as soon as possible. Wrap whole birds loosely.	3 days cooked pieces 2 days	(frozen) 0°F or below Store as soon as possible in original wrapping.	6 mo. to 1 yr.	Not recommended	
Seafood 	(fresh) 30°F to 34°F Store as soon as possible. Cover with crushed ice. Wrap to prevent from soaking up water.	up to 3 days fish not iced: 24 hr.	0°F or below Freeze in original wrapping.	3 to 4 mo.	Not recommended	
Eggs 	34°F to 40°F Refrigerate with large end up. Never wash eggs before refrigeration. Washing removes protective coating on outside of shell.	3 to 5 wk.	0°F or below Do not freeze in shell. Eggs can be frozen if removed from shell. Cooked egg whites should not be frozen.	up to 1 yr.	Not recommended	
Milk 	40°F or below	up to 10 days after date marked on carton if stored properly	0°F or below Allow space in container for milk to expand as it freezes. Freezing changes appearance and flavor, not value. Thaw in refrigerator.	3 to 6 mo.	Nonfat dry milk in airtight container	6 mo.
Butter 	40°F or below Store in original container.	several weeks	0°F or below May be frozen in original container.	9 mo.	Not recommended	

Food Storage Guidelines, Cont'd.

Food Product	Refrigeration		Freezing		Dry Storage	
	Temperature/ Procedure	Storage Life	Temperature/ Procedure	Storage Life	Temperature/ Procedure	Storage Life
Cheese 	40°F or below Cover tightly and store away from sources of strong odors.	4 to 8 wk. waxed cheese will last 3 to 6 mo.	0°F or below Cut into small pieces and wrap tightly in a moisture-proof wrap. Changes in flavor and texture begin after 6 weeks. Previously frozen cheese should be used for cooking purposes.	1 to 3 mo.	Not recommended	
Fruits and Vegetables 	40°F Most can be refrigerated. Do not wash berries, cherries, and plums before refrigerating to prevent mold. Do not refrigerate sweet potatoes, mature onions, hard-rind squashes, eggplants, and rutabagas.	varies greatly	0°F or below Tomatoes, salad greens, radishes, celery, and other crisp foods lose texture. Citrus fruits do not freeze well, but juices do. Sugar should be added to fruits to stop enzyme action. Vegetables should be blanched.	9 to 12 mo.	50°F to 70°F Apples, avocados, bananas, and pears can be ripened at room temperature. Store citrus fruits at a cool room temperature. Store potatoes in ventilated containers in a cool, dry, dark place.	5 to 7 days 4 wk.
Frozen Foods (convenience items) 	Refrigerate after cooking.	2 to 3 days	0°F or below Store promptly in original containers. Repackage if carton has been broken or if space is not available for carton.	3 to 6 mo.	Not recommended	
Canned Foods 	Refrigerate after opening.	3 to 5 days	May be frozen in a plastic bag or container after opening. Do not freeze in can.	3 mo.	50°F to 70°F Store on shelves in dry area. High-acid foods, such as tomatoes and pineapples, have a shorter shelf life.	2 to 5 yr.

Temperature of Food for Control of Bacteria Worksheet



Temperature of Food for Control of Bacteria

°C	°F	
121	250	121° C to 116° C — Canning temperature for low-acid vegetables, meat, fish, and poultry in pressure canner.
116	240	106° C to 102° C — jam-jelly stage
100	212	Boiling Point 100° C Temperature of boiling water at sea level. Temperature to can fruits, tomatoes, and pickles in a water-bath canner.
85		
80	180	100° C to 86° C — Simmering 80° C — Scalding Cooking temperatures destroy most bacteria. The time required to kill bacteria is less as temperature increases. 83° to 60° C — Pasteurizing
74	165	
60	140	Warming temperatures prevent bacterial growth, but allow the survival of some bacteria.
	125	Some bacterial growth may occur at this temperature. Many bacteria survive.
		DANGER ZONE: Temperatures in this zone allow rapid growth of bacteria and production of toxins by some bacteria. (Do not keep foods in this temperature zone for more than 2-3 hours.)
35	95	35° C — Lukewarm
30	86	26° C to 32° C — yeast dough rises
	60	15° C to 60° C — rennin, an enzyme, is active
10	50	60° C to 4° C — These temperatures allow the growth of bacteria and mold that cause food-borne illness.
4	40	
2	36	4° C — optimum refrigerator storage. Temperature for thawing frozen foods. Cold temperatures permit slow growth of some bacteria that cause spoilage.
0	32	Freezing Point
-18	0	Freezing temperatures stop growth of bacteria, but may not kill them.
-29	-20	-18° C to 129° C — Optimum freezer storage

The Hazardous Analysis Critical Control Point (HACCP) System of Classification

◆ The HACCP concept outlines the quality control procedure used by the food industry in food production plants and food distribution outlets to identify possible sources of contamination in food substances. This system was developed by the food industry for use as a quality control tool. The hazard analysis part of the HACCP concerns identifying critical points, such as sensitive ingredients or possible steps in processing that must be monitored to assure a safe food product. The critical control points are those steps in the food production process where quality control errors can result in an unsafe food product. The HACCP system is shown below.

The HACCP System

The hazard analysis critical control point procedure consists of three hazard categories:

Category 1

Hazards caused by the ingredients in the unprocessed product

The food producer may contain an ingredient that could introduce potentially pathogenic organisms or toxins in food or that may have a flavor, color, or nutrient which can change during processing.

Category 2

Hazards related to the manufacturing process

The manufacturing process may not effectively destroy harmful bacteria; it may decrease the strength of any protective elements in the food which prevent contamination, or it interferes with the maintenance of quality in the food.

Category 3

Hazards caused by inadequate planning for storage and distribution

During the distribution process, the storage period, or in the handling by consumers in retail outlets, the quality or safety of the product could be reduced due to lack of adequate packaging or sufficient levels of chemical preservatives in the product.

Analyzing Quality Control Standards for the Food Industry

Agency	Example of Quality Control Standard or Regulation	Purpose of Standard or Regulation	Should the regulation continue to be enforced?	Why?
Texas Department of Health			→	
Food and Drug Administration			→	
Environmental Protection Agency			→	
National Marine Fishery Service			→	
United States Department of Agriculture			→	

Definitions: Food Science and Food Technology

— What do we mean when we refer to “food science” or “food technology”? —

Food science — is a coherent and systematic body of knowledge and understanding of the nature and compositions of food materials, and their behavior under the various conditions to which they may be subject.

Food technology — is the application of food science to the practical treatment of food materials so as to convert them into food products of the kind, quality and stability, and so packaged and distributed, as to meet the needs of consumers for safe, wholesome, nutritious and attractive foods.

Thus, **food science** integrates the application to food of several contributory sciences. It involves knowledge of the chemical composition of food materials (for all food consists entirely of chemical substances); their physical, biological, and biochemical behavior; human nutritional requirements and the nutritional factors in food materials; the nature and behavior of enzymes; the microbiology of foods; the interaction of food components with each other, with atmospheric oxygen, with additives and contaminants, and with packaging materials; pharmacology and toxicology of food materials, additives and contaminants; the effects of various manufacturing operations, processes and storage conditions; and the use of statistics for designing experimental work and evaluating the results.

Likewise, **food technology** draws on and integrates the application to food of, other technologies such as those of steel, tinplate, glass, aluminum, plastics, engineering, instrumentation, electronics, agriculture, and biotechnology.

The Effects of Technological Advances on Food Availability

Directions: Write your responses to the questions in the space provided.

1. What advancements in food technology have impacted food availability in the United States in the past ten years?

2. What advancements in food technology have impacted food availability in other parts of the world in the past ten years?

3. Why does the United States lead other countries in the world in food technology research?

4. Why is this type of research important?

5. Specifically, how can these advancements positively impact food availability around the world?

6. How can these advancements negatively impact food availability?

7. What are past advancements in food technology that have increased food availability?

Interview of the Week

(This television interview takes place between a television news anchor and a marketing researcher for a large advertising firm.)

News anchor: Good evening. I'm (student's name). This evening on The Spotlight, Jamie Todd has joined us in our studios. Jamie is the Marketing Director from Does Mikey like it? Food Market Researchers, Incorporated. Thanks for joining us Mr./Mrs./Ms. Todd.

J. Todd: It is my pleasure.

News anchor: Mr./Mrs./Ms. Todd, how would you describe your job?

J. Todd: My job requires me to wear hats. My staff and I determine the likes and dislikes of Americans and report the information back to restaurants, grocery stores, and shopping centers so they can develop products Americans want. We do written surveys, telephone interviews, and interest group surveys.

News anchor: What do you do with the information?

J. Todd: We sell the information, if a company does not have a contract with us, to food related companies so they can create products Americans want.

News anchor: What type of questions do you ask during the interviews?

J. Todd: We determine what the food trends are and aren't, what appliances American kitchens contain, what working moms would like to see in convenience meals and cost concerns.

News anchor: What recent trends has your company seen lately?

J. Todd: The most recent trend that seems to be gaining strength is healthy convenience meals. The greatest area of growth is convenience meals that have higher quality and a more gourmet look and taste. There are more and more consumers who don't mind paying extra for convenient gourmet food.

News anchor: What do you mean by a "gourmet food"?

J. Todd: "Gourmet food" generally means higher quality ingredients and more unique, hard-to-locate ingredients.

News anchor: How would a person go about getting into your profession?

Interview of the Week, Cont'd.

J. Todd: I have a bachelor's degree from the University of Arizona in Marketing and a Master's degree in Food Science and Nutrition from Cornell University. Course work in statistics and data analysis are very helpful.

News anchor: How do you use statistics and data analysis in your career?

J. Todd: The easiest example that I can tell your viewers is this. In the last seven years, the enrollment in food science classes and requests for catalogs in gourmet ingredients has doubled. This translated into a different food consumer than ten years ago. The taste buds of Americans continue to evolve. Who knows what the next ten years will bring!

News anchor: From all of us at KTRX, thank you for your time. I am sure all of our viewing audience learned something. Thanks.

J. Todd: Thank you.

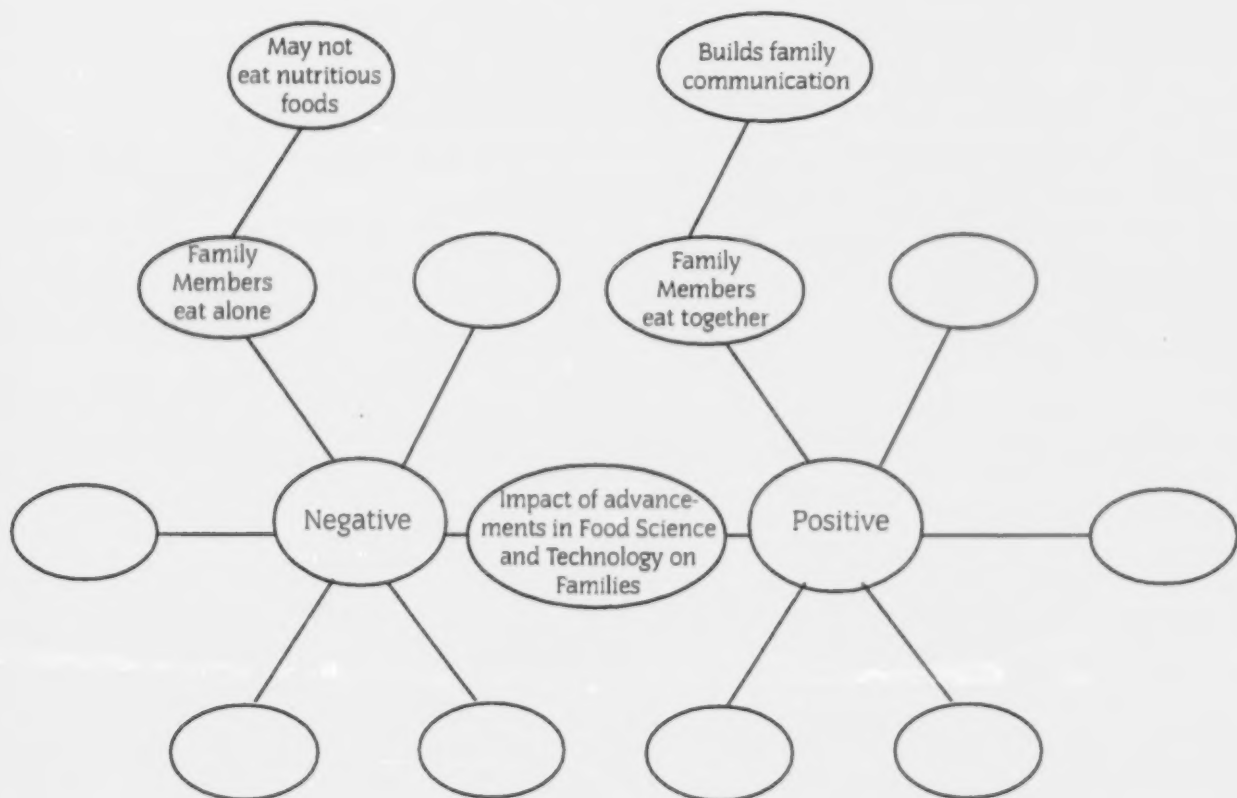
How Consumer Choices are Influenced by Marketing Techniques

Directions: Examine the four collages that you are assigned to evaluate. Write a brief response to the following questions for each collage on your own paper.

- What message is the advertisement or marketing strategy sending to the consumer?
- How did the advertisement or marketing strategy draw your attention?
- How are the different advertisements and marketing strategies similar?
- How are they different?
- How do these marketing strategies influence consumers?

The Impact of Advancements in Food Science and Technology on Family Strengths and Welfare of Family Members

Directions: Think carefully about what you have learned through readings and class discussion on advancements in food science and technology. Consider the implications these advancements have on families. Complete the web diagram, expanding if necessary to reflect your conclusion on this issue.



Nutrition Research

▲ Researchers have been trying to understand the human body and its nutritional needs for thousands of years. The famous Greek philosopher and scientist Hippocrates, who lived from 460 – 377 B.C., is considered the father of medicine. He hypothesized that “Persons who are naturally very fat are apt to die earlier than those who are slender.” More than two thousand years ago, people were curious about the human body and its nutritional needs.

A French gentleman by the name of Antoine Lavoisier (1743-1794) was the first to record a nutrition related experiment. He tested a theory that breathing is a measurable chemical process. He first studied guinea pigs and then a human, his assistant. The amount of oxygen consumed, the amount of heat lost, and the amount of carbon dioxide produced was measured. The research concluded that respiration was a combustion process chemically similar to reactions in which a substance actually burned. Lavoisier completed many experiments related to breathing and wellness. He determined that oxygen consumption increased during periods of exercise. While the experiments conducted by Lavoisier seem obvious conclusions today, his work has been refined by other researchers and his basic concepts have been proven correct.

A second French researcher conducted an experiment to prove that certain nutrients are essential to the health of both animals and humans. In the 1800s, Magendie carried out experiments designed to show that diet is related to health. He conducted an animal test that denied laboratory animals protein. The animals who were denied protein eventually died. Magendie concluded that protein is necessary for life.

The United States Department of Agriculture and Department of Health and Human Services both allocate millions of dollars annually to nutrition research. Experiments cover a wide range of nutrition concerns. The science of nutrition and eating continues to be a field with many unanswered questions.

Components of a Research Article

▲ Most research articles follow a similar format in reporting details of the study and conclusions that were drawn based on the results. Basically, it is similar to the process individuals use in writing a theme; most themes are written following a similar format although the topics vary widely. Such is the case with research articles. Although the topics vary from nutrition to the safety of electronic games, the method in which the research is reported in written form is very common and the accepted practice among researchers.

The components of a research article include the following:

The Abstract. The abstract is just a very brief overview of the research article.

The Review of Literature. The review of literature describes earlier research and up-to-date scientific knowledge on the topic.

The Methodology. This section of the research article includes definitions of key terms, procedures used in conducting the study, and descriptions of the instruments used in conducting the research.

The Results. In this section of the research article, the researcher(s) report the findings of the study. They may use tables and figures to organize and summarize the results so that the reader can more readily comprehend the results.

The Conclusions. The conclusions are statements of what the researcher(s) have concluded based on the findings (results) of their study. The conclusions should respond to the original research question and reflect the purpose of the study. Often, the conclusions section states additional questions that have occurred as a result of the study.

The References. This section is a list of references and resources the researcher(s) used in gathering information for the study, including any earlier studies that were relevant to the topic. The reference list should reflect efforts on the part of the researcher(s) to obtain a wide scope of knowledge on the research topic prior to conducting the study.

A Research Article

A HACCP Model for Home Delivered Meal Systems

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Individuals 65 years and older represented 12.7% of the U.S. population in 1994. The U.S. Census Bureau projects that this age segment will represent 13% of the population in 2000 and 20% by 2030 (United States Department of Health and Human Services, Administration on Aging, 1995). As the number of older adults increase, the demand for in-home services will escalate. For the older adult living at home, one option for meal preparation is to receive home delivered food via a community program such as Meals on Wheels.

The demand for home delivered meals has grown dramatically in recent years. The Elderly Nutrition Program (ENP) serves the general population under Title III and Title VI of the Older Americans Act, which cover congregate and home-delivered meals. Since 1980, home delivered meals have increased from 22% to 49% of total meals served through the ENP. Currently, 41% of the nation's home delivered meal programs have waiting lists (United States Department of Health and Human Services, Administration on Aging, 1997).

Very little research has been conducted regarding these home meal delivery services. Most literature concerning these programs addresses the social and nutritional impact of these meals rather than food safety practices (Challenge, 1995; Durenberger, 1987; Greely, 1990). In many food delivery operations, the meal is prepared at a centralized location, picked up at that point by volunteers and then delivered to client homes. In most situations, a hot meal is delivered daily. Since these food deliverers are volunteers, they may not be required to attend any formal food safety training.

The use of potentially hazardous foods in the preparation of the meal creates a possible high risk situation. Since the elderly have been identified as a group at high risk for

foodborne disease, it is crucial that food must not be microbiologically compromised during preparation or delivery. Time and temperature are of extreme importance, but a system for controlling and monitoring these parameters is often lacking.

The Food and Drug Administration (FDA) and the National Advisory Committee on Microbiological Criteria for Foods (NACMCF) recommend that Hazard Analysis Critical Control Point (HACCP) systems be immediately implemented by establishments and institutions preparing foods for the elderly or any other high risk individuals. HACCP is a prevention-based food safety program designed to minimize the occurrence of potential food safety problems. It is a technique and a thought process that treats storage, preparation and service of food as one continuous system (United States Department of Health and Human Services, 1993).

Specific steps of the HACCP system include (a) conducting a hazard analysis, (b) identifying the critical control points in the process, (c) setting critical limits for preventive measures associated with each critical control point, (d) establishing critical control point monitoring requirements, (e) developing corrective actions to be taken when monitoring indicates a deviation from established critical limit, and (f) establishing effective record-keeping procedures for the system. Even though these steps are integral for organizing the process, HACCP has no single correct application and must be tailored to the specific operation (United States Department of Health and Human Services, 1993).

Purpose

The purpose of this study was to develop a HACCP system model for home delivered meals based on a case study of one program.

*A Research Article, Cont'd.***Procedures**

Permission was secured to observe a home-delivered meal operation in the North Texas region. The program currently prepares, packages, and delivers over 2,500 hot meals each weekday using both volunteer (65%) and paid personnel (35%) delivery. A two-day HACCP inspection was conducted to determine the flow of food throughout the operation, including the preparation, packaging, and delivery of the meals to clients. Interviews were conducted to supplement information obtained during inspection. Utilizing the acquired information, a HACCP system model was developed.

Results

A proposed HACCP system model for home delivered meals is shown in Table 1. This model identifies critical items most likely to increase food safety risk. When these components are properly controlled, food safety hazards may be prevented, reduced, or eliminated. Certain measures can be applied to reduce the risk of critical items. Selection of precooked meats or pasteurized foods helps eliminate microbial risks posed by raw products. Use of pre-packaged single serve food items eliminates the risk of contamination due to improper worker hygiene or contact with other foods and equipment. Cooking or heating hot food to a minimum of 180°F ensures microbial destruction and allows for a temperature drop during the delivery. Use of sealed aluminum foil compartmentalized containers for hot foods prevents spillage/seepage and external contamination during delivery. Cold holding temperatures (41°F), although often not considered, are just as important as hot holding temperatures (140°F) in preventing the growth of pathogenic organisms. The FDA Food Code (United States Department of Health and Human Services, 1995) recommends that cold food be held at 41°F. Since cold temperatures will rise during delivery, cold foods should be held as close to 35°F as possible to allow for the temperature increase. Insertion of hot and cold packs in thermal containers aids in maintaining proper temperature during meal transport. Volunteer training should emphasize proper hygiene, especially handwashing, and the importance of keeping food in insulated containers to maintain proper food temperatures. The time span between packaging and delivery of meals must not exceed four hours.

Implications

Home-delivered meal operations are unique in that all food is packaged for delivery to consumers outside the operations facility. Demand for home-delivered meals is expected to escalate as the population of older adults grows. Various local agencies will operate this type of service, utilizing volunteers to offset budget restraints. Menu planning should focus not only on meeting nutritional guidelines but also on selection of foods that minimize food

safety risks. A program that conforms to a HACCP systems model must be in place to ensure that the meals delivered to homes of elderly clients are safe.

References

- Challenge: How to improve nutrition services to homebound elderly. (1995). *Food Management*, 30, 58.
- Durenberger, D. (1987). Action needed now for long-term care needs for the future. *Business and Health*, 5, 60.
- Greeley, A. (1990). Nutrition and the elderly. *FDA Consumer*, 24, 24. United States Department of Health and Human Services (1993). *HACCP. Regulatory applications in retail food establishments*. (DHHS Publication No. 1994-522-235/81239). Washington, DC: U.S. Government Printing Office.
- United States Department of Health and Human Services. (1995). *Food Code*. Springfield, VA: U.S. Department of Commerce.
- United States Department of Health and Human Services, Administration on Aging. (1995). *A profile of older Americans: 1995*. Available at: <http://www.aoa.dhhs.gov/aoa/pages/profil95.html>
- United States Department of Health & Human Services, Administration on Aging. (1997). *Executive summary: Serving elders at risk; the Older Americans Act Nutrition Programs - national evaluation of the Elderly Nutrition Program, 1993-1995*. Available at: <http://aoa.dhhs.gov/aoa/nutreal/execum.html>

A Research Article, Cont'd.

A HACCP System Model for Home Delivered Meals		
Operational Steps	Critical Control Points	Critical Control Standards
Plan Menu	Identification of PHF*	⇒ Reduce PHFs* in menu/recipes ⇒ Purchase pasteurized/precooked items
Purchase and receive food	Deliver at proper temperature Secure packaging Immediate storage	⇒ Purchase from approved source ⇒ Maintain time/temperature standards
Prepare food	Thawing Handling and preparation Cooking and hot holding Cooling and cold holding temperatures Worker hygiene	⇒ Avoid cross-contamination ⇒ Thaw under refrigeration ⇒ Cook to minimum recommended ⇒ Cool rapidly ⇒ Wash hands/single use gloves
Package food	Secure container to maintain heat/prevent external contamination	⇒ Ensure hot food is 180°F ⇒ Ensure cold food is at 35°F ⇒ Seal container properly ⇒ Store food immediately in proper thermal container ⇒ Maintain employee and environmental hygiene
Hold Food		
Hot	Holding of packaged food in thermal containers to maintain 140°F minimum	⇒ Use hot pack in insulated containers
Cold	Holding of packaged food and drinks in thermal containers to maintain 41°F maximum	⇒ Use cold pack to maintain temperature ⇒ Take temperature reading quarterly per route per year
Delivery of meals	Training of workers or volunteers Personal hygiene	⇒ Deliver promptly ⇒ Maintain meals in hot/cold storage Wash hands after possible contamination
*PHF = Potentially Hazardous Food		

Table 1

Evaluating Current Research Projects

1. What is the title of the research paper?
2. Who conducted the research?
3. What was the purpose of the project?
4. What was learned from the review of literature?
5. What methodology (research method and procedures) was used in the research?
6. What were the results (findings) of the study?
7. What conclusions were drawn by the researchers?
8. What is the value of this research to the field of food science, food technology, or nutrition?
9. What is the value of this research to society?
10. What did you learn from reading this research article?

The Scientific Method of Investigation

◆ The scientific method is a means of solving problems scientifically; it is a methodical process of controlling and manipulating variables while adhering to scientific standards of attitude and behavior. However, actual steps in the scientific method may vary. Generally, the scientific method includes the following steps:

- 1) Identify the problem and state it clearly as a question.
- 2) Gather information by such means as reading, interviewing, observing, and surveying.
- 3) Form a hypothesis, or possible answer to the problem, based on information gathered through research or observation.
- 4) Test the hypothesis through experiments or carefully recorded and classified observations.
- 5) Draw conclusions based on results.

Merriam Webster's Collegiate Dictionary (10th ed.) defines **research** as the collection of information about a particular subject and investigation or experimentation aimed at the discovery and interpretation of facts. Research is the formal, systematic application of the scientific method to the study of problems. The steps involved in conducting research closely parallel those of the scientific method and include the following:

- 1) Selection and definition of a problem
- 2) Execution of research procedures (gathering of information and collection of data)
- 3) Analysis of data
- 4) Stating conclusions (compilation of findings)

Observations are an effective means of gathering information. Observations should be accurate, precise, and recorded in an organized format. The use of instruments, such as microscopes, rulers, cameras, or magnifying glasses, can increase the accuracy of sensory observations. **Interpretations** are conclusions that are based on observations. The validity of interpretations is increased when the interpretations are supported by multiple observations.

Attitudes central to research and scientific inquiry include honesty, objectivity, openness, skepticism, questioning, accuracy, carefulness, and unbiased evaluation. Regardless of the selected project focus, it is important to recognize and understand the importance of these attitudes to the success of any investigative study.

Hunger in Our World

Directions: Discuss each of the following questions with your group members. Have one person record responses to be shared with the class.

1. What is hunger?
2. What is malnutrition?
3. What is the relationship of hunger to malnutrition?
4. What are symptoms of malnutrition?
5. How is health affected by malnutrition?
6. How is quality of life affected by hunger and malnutrition?
7. What is the relationship of the food supply to quality of life?

Factors Affecting the Food Supply

Limited World Food Production

It is estimated that by the year 2000, the world's population will reach six billion, and 80 percent of these people will live in the developing countries. The developing countries are the nations with severe economic problems that are working to become more industrialized. These countries must increase food production, work toward reducing the rate of population growth, and increase economic development. The developed countries will have to assist these countries in domestic agricultural reform.

Limited Nutrition Education

Lack of education concerning nutritional needs for good health is a factor in the many problems associated with hunger and malnutrition. **Hunger** or **undernutrition** is a state of weakness caused by the need for food. It occurs when the body lacks nourishment. **Overnutrition** is the intake of excessive amounts of food that leads to overweight and obesity. Nutrition education is important because often the food needed for a balanced diet is available, but people choose other items because they lack the education and information to make wise food choices based on nutritional needs.

Traditional Value Systems and Social Organizations

Many people feel that if the poor people of developing countries had fewer children, there would be more food. It is true that when there are more people to feed, a smaller amount of food will be available for each one. However, for people living in poverty, having many children is a means of survival. The high infant mortality rates in developing countries means that families can expect only a few of their children to reach adulthood. In those countries, children are needed to help earn extra income for the family and to take care of their parents in old age.

Land Ownership and Tenure Relationships

In many countries, tenure relationships exist between landowner and farmer. **Tenure relationships** are agreements between the landowner and the farmer whereby the farmer pays the landowner money, crops, or both in order to farm his land. Farmers who farm their own land face strict government policies that limit crop process and reduce available credit.

Political Climate

Very few countries have institutions or organizations whose goals are to end world hunger. Many developing countries fall behind in technology and production because they do not place much emphasis on agricultural development. In many poor countries, the government officials and politicians are not even aware of the hunger problems in their own countries. They exclude themselves from exposure to the poor people who have no political voice.

Factors Affecting the Food Supply, Cont'd.

Lack of Income

Individuals and families who live in poverty face many overwhelming obstacles, such as a lack of land on which to grow their own food, a lack of funds to purchase farm equipment if they do own land, and a lack of funds to purchase nourishing food. Poverty and hunger cause illness and weakness that prohibit people from holding jobs that could produce income to buy food.

Lack of Proper Transportation and Storage Facilities

Developing countries lack modern facilities for storing and distributing the crops that they raise. The absence of modern farm equipment and supplies, poor roads, and limited access to trucks and other means of transportation inhibit the distribution of food. Poor storage conditions invite insects and pests that destroy a large percentage of harvested crops.

Customs, Superstitions, and Religious Influence

Superstitions about food products exist in many cultures of developing countries. People living in these cultures believe that consuming certain foods brings evil or hardship to a family. Even though they might be hungry and malnourished, the people in these countries do not eat certain foods that might provide proper nutrition because of cultural or religious reasons.

Illiteracy

In the countries where the population continues to grow at a rapid rate, a large percentage of those reaching adulthood are illiterate. These countries do not have the funds or facilities to provide for education of the population. With the ability to read and write comes the ability to obtain better jobs and to learn about the importance of good nutrition and health.

Living to Survive

Case Study #1

Jerja is four years old and is the only living child of Dara and Miti. Jerja's parents have lost seven children due to disease and starvation. Jerja sits at his mother's feet all day, too weak to get up with some of the other children in the village. Jerja and his parents eat only once a day, usually a combination of some barley and root soup. Jerja has never eaten any meat but has feasted on insects. Miti's job is to carry water by oxen from the river to the small village. Last month, the UNICEF workers brought them fresh fruit.

Case Study #2

Luke lives with his parents in a one-room house nestled on the side of a mountain under huge pine trees. Luke's mom is pregnant with her second child; his dad works in the mines on the other side of the valley. Luke is six years old and attends school at the bottom of the mountain in a small coal mining town in Tennessee. Luke is able to eat breakfast and lunch at school. During the summer, he helps his mom tend to a small garden. There is no running water or electricity in the house. Luke helps his parents carry water from a nearby stream.

Case Study #3

Mena is a young woman almost twelve years old. She was orphaned at the age of seven. For the past two years, she has stayed at a local church hospital recovering from tuberculosis and rickets. She is well enough to be on her own and has just moved to a nearby village. Mena will live with a distant relative who will teach her to make jewelry native to their country.

Case Study #4

Joseph and his young son, Darin move often from shelter to shelter. Joseph is trying hard to find a job, but it is difficult to find someone to care for Darin while he is at work. Darin is four years old. His mom died last year from complications of diabetes. Joseph and Darin only have each other. Darin has never lived in a real home like most other kids in the United States. His only home has been in a shelter or in a truck van. He has never been out of the city. It is the only life he knows.

You Are an Ambassador to the United Nations

Directions: Assume you are an ambassador to the United Nations from one of the developing countries. Respond to the following questions.

1. What would be your country's greatest needs?
2. What kinds of aid would you ask for from the developed nations?
3. If your country was given food aid, what problems might you encounter in assuring that the food supplies reached the hungry citizens in your nation?

Nutrition in Developed and Developing Countries

Instructions:

1. Use references and resources to complete the chart below. Select a developed country other than the United States and then select a developing country. The objective of this activity is to compare and contrast the nutrition in developed and developing countries.
2. Prepare a map(s) that shows the location of your two countries.
3. Answer these two questions on the back of this sheet.
 - (a) How is the nutrition in those countries similar?
 - (b) How is the nutrition in those countries different?

Include your references on the back of this sheet or on your own paper.

	My Developed Country is: _____	My Developing Country is: _____
1. What is the average family size?		
2. What is the average family income? Compute per capita amounts.		
3. What is agricultural production like in this country?		
4. What foods are available?		
5. What nutrition education programs are available?		
6. What health care is available?		
7. What diseases are prevalent?		
8. What religious influences exist that affect food consumption and nutrition?		

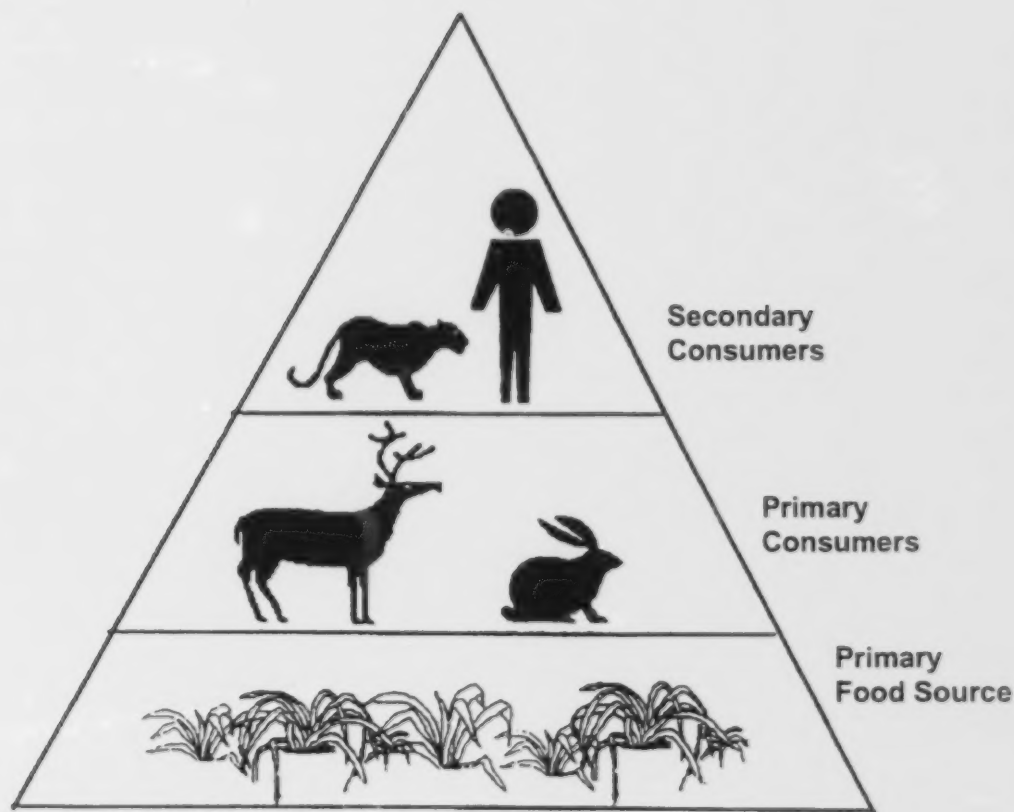
The Food Chain

▲ The primary function of the food chain is to supply food to the organisms at all levels.

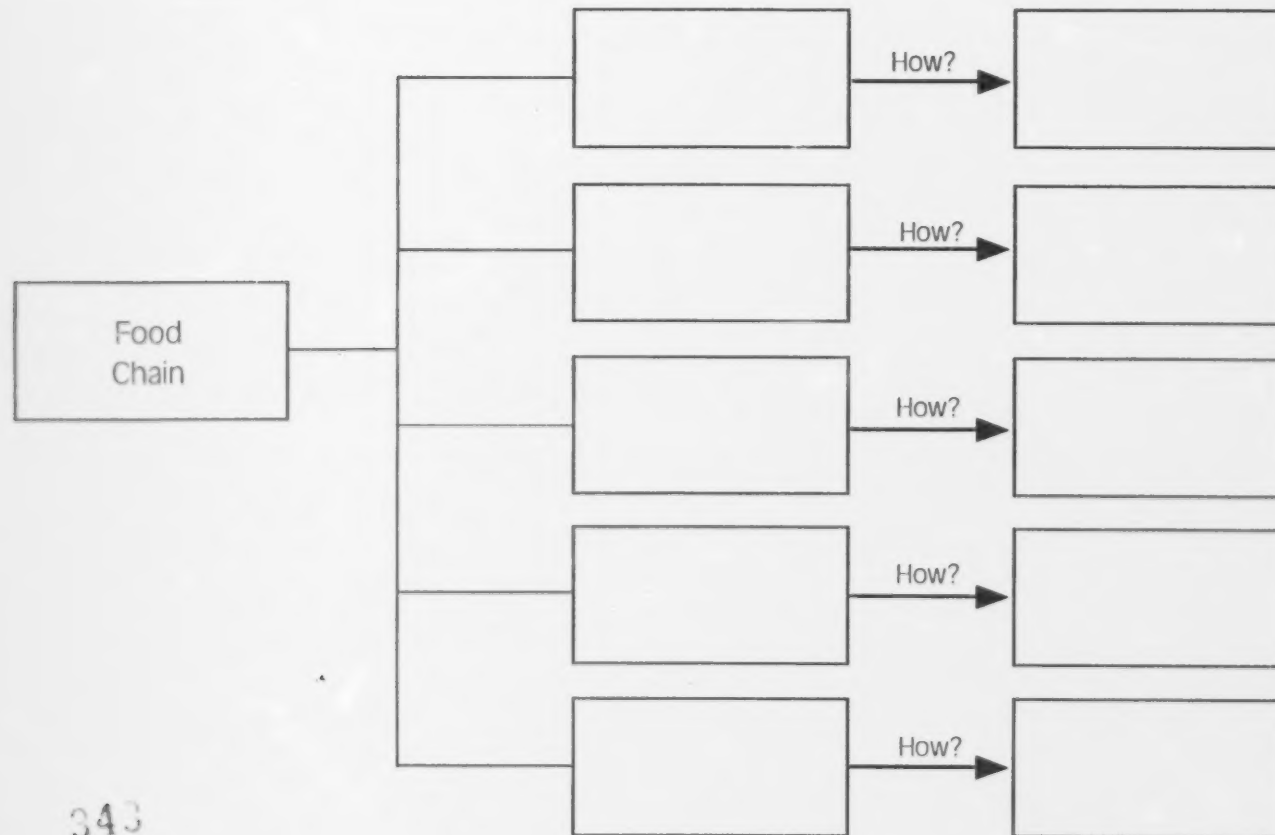
The food chain has five levels:

1. Seeds are planted.
2. Plants grow.
3. Animals eat plants.
4. Man eats animals and plants.
5. Food supplies man with nourishment to plant more seeds.

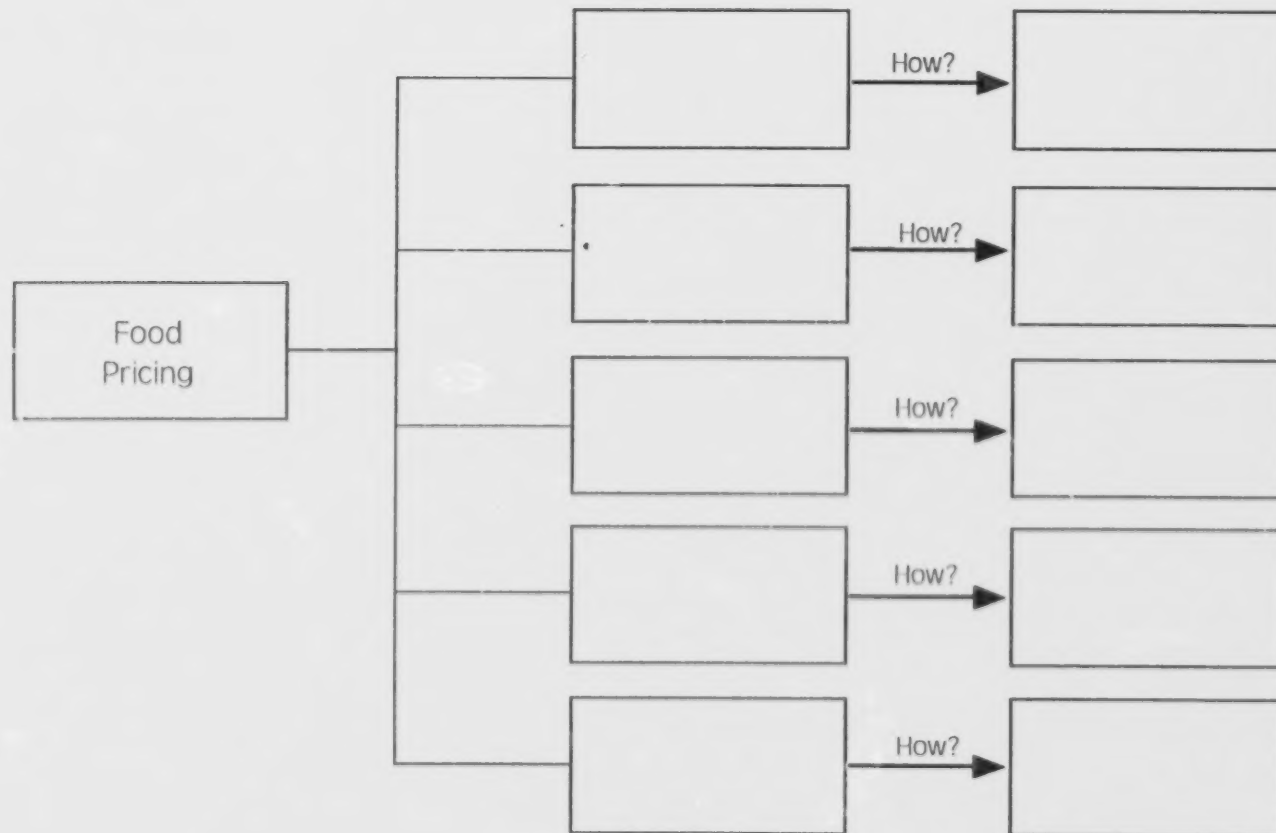
The Food Web



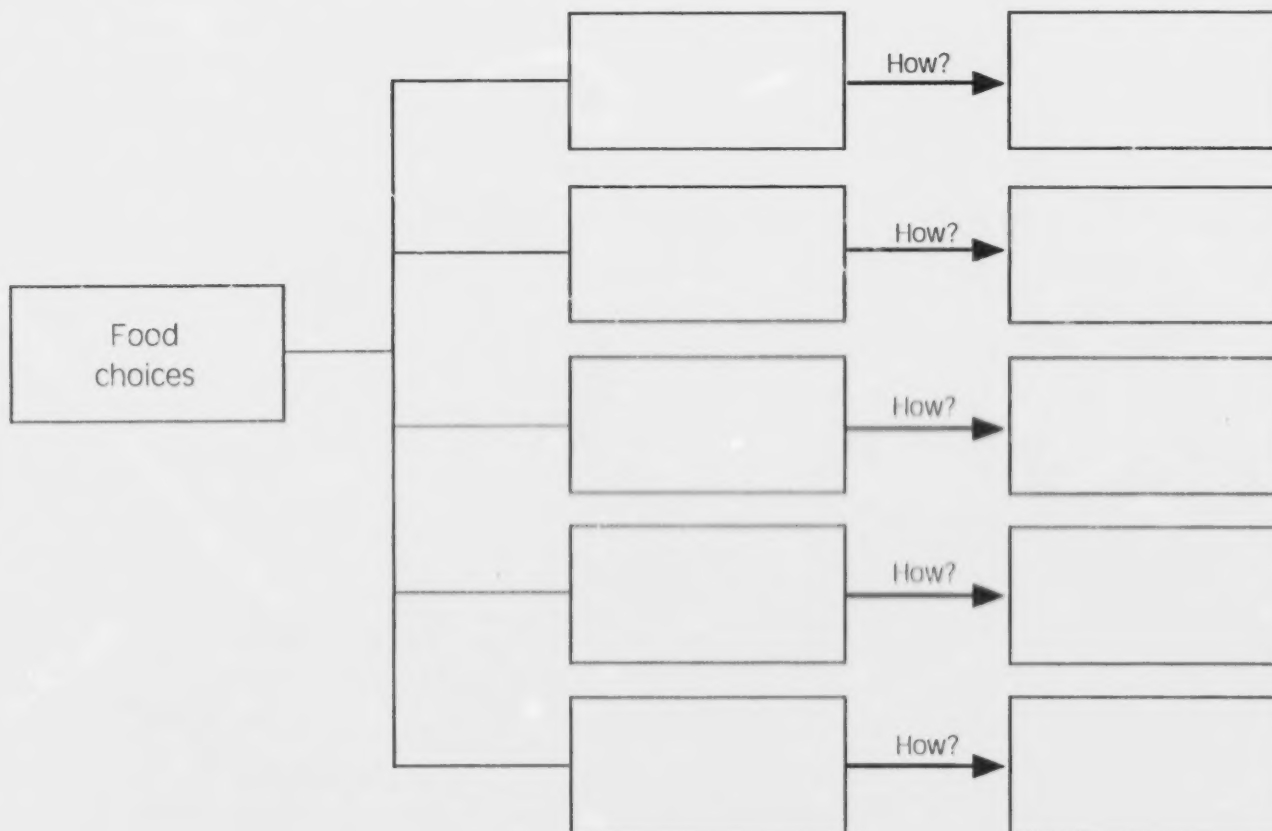
Analyzing Factors that Influence the Food Chain



Analyzing Factors that Influence Food Pricing



Analyzing Factors that Influence Food Choices



The World Food Supply

Political Factors

- Political Climate (Unrest, hunger, and poverty not a priority)
- Government regulations
- Political figures exclude themselves from exposure to problems in their country

Economical Factors

- Poverty
- Land ownership and tenure relationships
- Lack of funds to purchase farm equipment
- Lack of funds to purchase nourishing food

Social and Cultural Factors

- Traditional value systems
- Customs
- Superstitions
- Societal and cultural food patterns

Ecological Factors

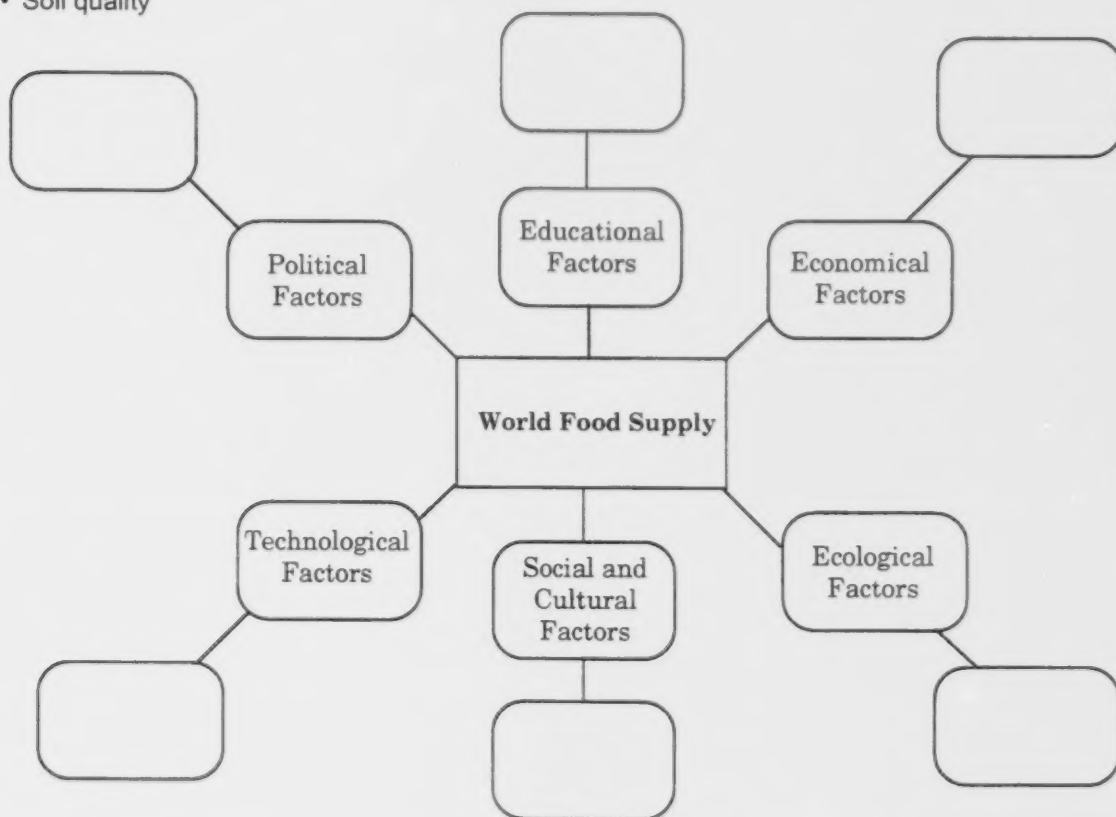
- Disasters
- Climate
- Soil quality

Educational Factors

- Need for nutrition education
- Lack of agricultural education
- Illiteracy

Technological Factors

- Postharvest technology
- Industrialization
- Need for increased food production
- Transportation facilities
- Storage facilities
- Food reserves
- Agricultural capabilities
- Green revolution
- Marketing
- Biotechnology
- Genetic engineering
- Aquaculture



Living the Life of the One Billion Poorest in Our World

☞ Think of your home as it is today. Imagine the furniture, the appliances, the entertainment equipment. Think about the food in the cupboards and the refrigerator. If there is a family pet in your home, think about how it is treated and what it is fed. Create a picture in your mind of what you will eat for dinner tonight and the snacks you might have later in the evening.

Now imagine that you and your family are to be transferred into an equally typical family of the underdeveloped world. First, most of the furniture will be removed from your house. After the beds, chairs, tables, light fixtures, and all of the electrical appliances (including televisions, stereo, radio, and telephone) are gone, your family will be left with a few old blankets, a kitchen table, and one wooden chair. All of the clothing in the house will go — each member of the family may keep his or her eldest pair of clothes. The head of the family will have a well-worn pair of shoes, but none for the rest of the family.

Let's move into the kitchen. There is no refrigerator and the cupboards are bare. One box of matches, a pound of flour, and small amounts of sugar and salt are left. There will be no food for the family pet — it will have to fend for itself. A few moldy potatoes will provide much of tonight's meal. Along with a few onions for flavor and some beans, this will provide the only food for the entire family tonight and tomorrow.

The house has been stripped: no bathroom, no running water, no electricity. In fact, your house will be taken away. The entire family can move to a shed. It is crowded, but not unlike the way families live in many parts of the world. A United Nations report describes the living conditions of families in one poor country this way: "It is not uncommon for a family of four or more to live in a bedspace, that is, on a bunk bed and the space it occupies — sometimes in two or three tiers — their only privacy provided by curtains."

Even with all of this, your family is still not living at the level of life in the greatest part of the world. All of the other houses in your area also have been removed; the whole area has become a shanty town. There is no communication from the outside world. There is only one radio in the entire town. No more newspapers, magazines, or books available, but it does not matter. No one in your family can read them anyway.

Government services are nonexistent. There are no mailcarriers, no firefighters. Only one, two-classroom school serves the entire neighborhood, but it does not matter, since only a tenth of the children in the neighborhood go to school. The nearest medical clinic is ten miles away and is tended by a paramedic. People who need medical care must either walk to the clinic or take the bus which comes by every other day or so. They might be lucky and find a seat inside the bus, instead of having to climb on top for a ride.

Finally, your family will be allowed to keep a cash hoard of five dollars. Meanwhile, the adults and older children in the family must earn their keep. As a peasant farmer, the head of the household may have two to three acres to tend, raising the equivalent of \$200 to \$500 worth of crops a year. There will be enough for the family to eat. Or almost enough. The adults in the family will average a daily caloric intake of 1700 to 1900 calories. Because of the hard work and malnourishment of an unbalanced diet, in addition to the hazards of disease, your life expectancy will drop to around 40 years of age.

These are the subsistence living conditions of over one billion people in the world today. Of course, this offers only an impression of what life is like for these people. Still lacking are the things that underdevelopment gives as well as those it takes away: the smell of poverty, the sight of diseased, suffering people and animals, the flies, the open sewers. When we are told that half the world's population represent the poorest in their own "underdeveloped" countries, this is what the figures mean.

Adapted from Heilbroner, Robert L. *The Great Ascent*. Harper and Row, 1963.

Game Board

Start	The World Food Supply Game Place Game Cards Here				Home!!
Answer a question!					Answer a question!
Move forward 3 spaces					Just resting!
Answer a question!					Trade places with the person on your left
Move back 3 spaces					Answer a question!
Lose your turn					Lose your turn
Answer a question!					Answer a question!
FREE SPACE!	Move back 2 spaces	Answer a question!	Move ahead 1 space	Just resting!	FREE SPACE!

Game Card Sets

Explain how geographical factors affect the world food supply. Possible answers: Poor soil; too mountainous; not enough land to grow crops; too little or too much rain; lack of farm equipment.	What food products does the United States export? Possible answers: One-third of America's crop output is expected at the present time; exports include wheat, corn, sorghum, soybeans, soybean meal, soybean oil, rice, cotton, and meat.
Which factors affecting the food supply would have the greatest effect on a country's food supply? Possible answers: Answers will vary depending on the country selected to discuss. In most developing countries, economic and political factors will have a great effect on the food supply.	What food products do other countries import to the United States? Possible answers: Some examples of food products imported to the United States are coffee, tea, cocoa, bananas, and spices.
What determines a country's ability to import or export products? Possible answers: If the country has free trade; if a tariff was added on some products by a country; if there was a quota or other trade barriers.	What are commodity foods? Possible answers: Commodity foods are surplus food products that are stored as a result of farm price support programs. Commodity foods are used in schools, food and nutrition welfare programs, and military foodservice.
What would be the effect on Russia if they could not receive imported grain from the United States? Possible answers: Foods for the Russians staple diet are made of grain; climatic conditions prevent growing of some grains; production does not meet consumption needs; economy does not allow paying for imports; need government aid.	How does the commodity food program help producers? Possible answers: By giving the farm producers a market for surplus products.
How have the export food products from the United States affected the diets of people in other countries, such as India and Japan? Possible answers: Grains help curb malnutrition and hunger in India and other developing countries; meat provides more protein in Japanese diets where school seats have been elevated because of increase in height due to higher protein diets of children.	Palm oil is a food which is imported to the United States from some of the Asian countries. What dietary effect could this oil have on the diets of the people in this country? Possible answers: Palm oil is a saturated fat. Even though it is derived from plants, it is believed to cause an excess of cholesterol in the bloodstream leading to possible heart disease.

Organizational Goals Toward Solving World Hunger Problems

- to raise people's level of nutrition
 - to raise people's standard of living
 - to improve the efficiency of food and agriculture production
 - to improve the distribution of food and agriculture products
 - to better the conditions of rural populations
-



Preamble to the Constitution of the Food and Agriculture Organization

(Ratified by 42 countries in 1945)

The nations accepting this Constitution being determined to promote the common welfare by furthering separate and collective action of their part for the purposes of the following:

- raising levels of nutrition and standards of living of the people under their respective jurisdictions
- securing improvements in the efficiency of production and distribution of all food and agriculture products
- bettering the conditions of rural populations

And thus contributing toward an expanding world economy,

Hereby established the Food and Agriculture Organization of the United Nations

Program Goals of the World Health Organization (WHO)

1. Development and testing of methodologies for integrating nutritional objectives into national development plans
 2. Development and testing of methodologies for establishing nutrition monitoring and surveillance systems as a basis for action programs and for their evaluation
 3. Integration of nutrition activities primarily within maternal and child care, as a component of primary health care
 4. Promotion of and collaboration in measures for the control of endemic goiter
 5. Further development, and the testing under varying conditions, of methods for control of vitamin A deficiency and nutritional anemia
 6. Promotion and support of further studies needed for a better understanding of factors responsible for malnutrition and related problems
 7. Collaboration in training health workers in nutrition
-

Terms Associated with Hunger

- ⇒ ***hunger*** – a state of weakness caused by the need for food; a physiological and psychological condition when enough nourishment has not been eaten to meet the body's energy needs.

- ⇒ ***malnutrition*** – a condition that arises after a long-term period of insufficient calories and nutrients to meet metabolic and developmental needs or that arises as a result of long-term excess intake of calories than is needed for metabolism and development. Both conditions lead to serious health problems.

- ⇒ ***undernutrition*** – the condition of poor health and immunity to disease that results after a long period of insufficient dietary intake of nutrients and calories to meet the body's requirements for growth, development, and metabolic functions.

Problem Solving



Recognize the problem.



Evaluate information needed to solve the problem.



Analyze choices and consequences.



Select the best choice.



Outline and implement a plan of action.



Note the results of your action.

Source: Nutrition and Wellness Resource Guide: A Resource for Teaching the Nutrition and Wellness Core Course Area of Ohio's Work and Family Life Program, (Columbus, Ohio: The Ohio State University, Vocational Instructional Materials Laboratory). Copyright 1994. Used with permission.

Solving Problems Through Effective Reasoning

In order to reason through problems and find the best solution for self and others, it is important to consider many things about the problem, the situation, the possible solutions, and the consequences of your choice. The REASON model can help you work through complex problems. The components do not need to be used in the order given, but each component is important to the reasoning process.

Recognize the Problem: Problems can be very complex, and sometimes just identifying the problem itself can be a real challenge. Each problem has a unique context, and the context of the problem can influence the solution. At this point, it is important to consider what you really want to happen when this problem is resolved — in other words, determine your “desired ends.” Ask yourself the following:

- What is the problem?
- Why is it important for me to address this problem?
- What is the context of this problem?
- What caused the problem?
- Who is involved?
- What factors about this problem will affect my decision about what to do (resources available and situational factors)?
- What goals do I have for the solution to this problem? What are the desired ends I want to achieve?

Evaluate Information Needed to Solve the Problem: Solving problems requires information about both facts and priorities. Information about facts includes the concepts and knowledge that will help you develop and evaluate choices. Information about priorities includes your personal priorities and the priorities of others involved who will help you decide which choice is best. Ask yourself the following:

- What factual information is needed?
- Where can I obtain this factual information?
- What are my personal priorities regarding this problem situation? Which of these priorities are most important?
- What are the priorities of others involved in this situation? How will those priorities influence my decision about what to do?
- What criteria will I use to decide which is best?

Solving Problems Through Effective Reasoning, Cont'd.

Analyze Choices and Consequences: There is always more than one choice involved in a problem. Sometimes there may be many choices. Even doing nothing about a problem is a choice. Each choice carries with it possible consequences, consequences for yourself and for others as well as both short-term and long-term consequences. Ask yourself the following:

- What choices are possible?
- What are the short-term and long-term consequences of each choice for myself and others?

Select the Best Choice: Making a decision about which alternative is best means evaluating each alternative against identified priorities and desired ends. Ask yourself the following:

- Which choice best reflects my priorities and the ends I desire regarding this problem?
- Which choice would result in the most positive consequences for myself and others?
- Which choice works best for this particular situation?

Outline and Implement a Plan of Action: Problems are not solved until a reasoned decision is put in to action. Action requires careful planning. Ask yourself the following:

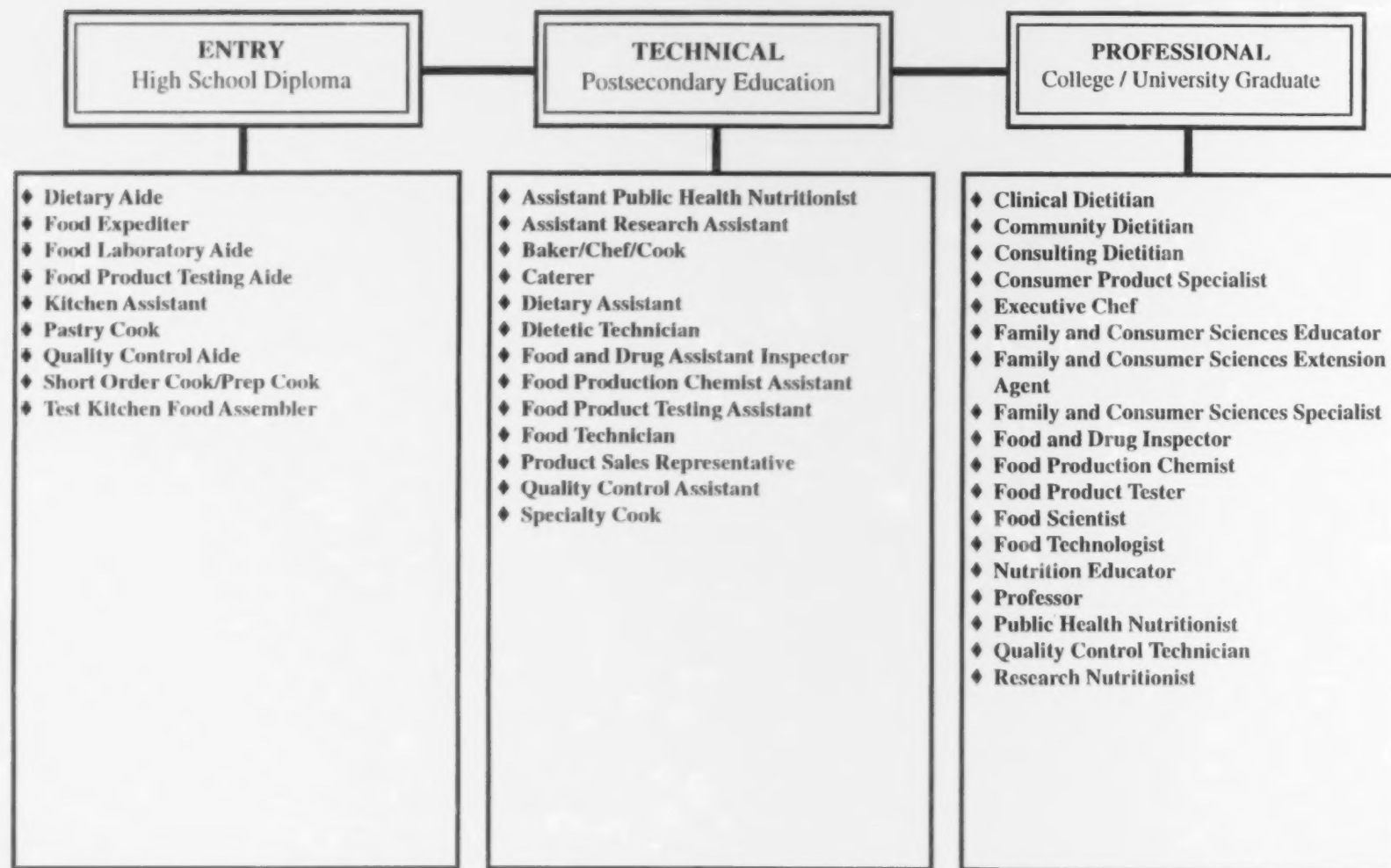
- What do I need to do to carry out this choice?
- What resources do I need to carry out this choice?
- How can I organize these various tasks to achieve this solution?

Note the Results of Your Action(s): Evaluating the outcome of your choice will help you determine if it was the best solution and will help you continue to develop your problem-solving skills. Ask yourself the following:

- Would I make the same choice again? Why or why not?
- What have I learned?
- How will this problem-solving experience affect my problem solving in the future?

Career Concentration: Nutrition and Wellness/Food Science and Technology

Examples of Career Opportunities



Careers in Food Science and Technology

Part A: What are the career opportunities?

Directions: Many different kinds of career opportunities are available in your assigned area. Maybe there is one that is right for you. Fill in examples of occupations in each category.

- | | | |
|------------------------|-----------------------|------------------------|
| 1. Working with Things | 2. Working with Ideas | 3. Working with People |
| a. | a. | a. |
| b. | b. | b. |
| c. | c. | c. |

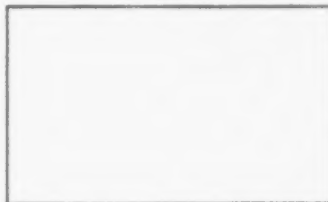
Part B: What is Available?

Directions: Search in newspapers for help wanted ads. Find one for each category above and copy the ad in the space provided.

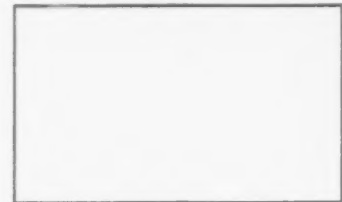
4. Working with Things



5. Working with Ideas



6. Working with People



7. Which occupation appeals to you most?
8. Complete the following about the occupation that appeals to you most.
 - a) preparation requirements/qualifications:
 - b) number of work hours per week:
 - c) dress requirements:
 - d) salary:
 - e) geographic location:
9. What is your idea of the perfect career?
10. On the back of this sheet, write a "help wanted" ad for a newspaper describing your idea of a perfect career.

GOALS

Goals – the aims you are trying to reach or the things you want to achieve

Long-term goals – goals that may take months, a year, or many years to reach

Short-term goals – goals that may be met in a few hours, day, weeks, or months

How Many Roles Do You Juggle?

DIRECTIONS: Individuals play many roles in their lives. Look at the sample roles listed below and place a ✓ in the blanks beside those roles that you play at the present time.

- | | |
|--|------------------------------|
| _____ son/daughter | _____ student |
| _____ friend | _____ employee |
| _____ club/organization member | _____ husband/wife |
| _____ parent | _____ boyfriend/girlfriend |
| _____ volunteer | _____ team/club member |
| _____ brother/sister | _____ granddaughter/grandson |
| _____ niece/nephew | _____ cook |
| _____ grandmother/grandfather | _____ citizen |
| _____ stepmother/stepfather | _____ boss/employer |
| _____ neighbor | _____ other: |
| _____ caregiver (elder or other family member) | |

Which of these roles do you consider to be your most important role?

Which roles will you probably retain throughout your life?

Which roles will you have in the future that you do not have now?

Which of these roles do you think your parents would identify as your most important role?

If you do not live with your parents, which role do you think the person you live with would identify as your most important role?

Is it ever difficult for you to choose which role to handle at a given time? If so, how difficult is it? Why?

Keys to Management of *Multiple Roles*

- Planning
- Organizing
- Implementing
- Evaluating



POSITIVE HUMAN-RELATIONS SKILLS

- Attitude
- Personality
- Self-Control
- Initiative
- Honesty
- Cooperation

The Employment Portfolio

▲ An employment portfolio is useful for the following family and consumer sciences objectives:

- to assess personal career interests and abilities
- to evaluate interpersonal and occupational skills
- to demonstrate effective written and electronic communication skills
- to develop an effective technique to secure employment

Portfolios to secure employment or to demonstrate workplace skills are more focused and more professional looking than other types of portfolios. The employment portfolio will include a resumé or a description of skill and experiences. A goals statement or career objective can be included as a part of the resumé or as a separate item in the portfolio. The objective should be broad enough to allow the student to use the portfolio for more than one specific job, but narrow enough to create a reasonable frame for the portfolio contents.

When attempting to document skills, the student will need to seek pieces of school work or workplace products to answer the following questions in Table 1.

Question	Types of Evidence
What evidences best show what I know?	tests, research projects, comments from teachers and employer
What evidences best show what I can do?	lab results, employer evaluations, personal reflections on skills and behavior
What evidences best show how I get along with others?	employer/supervisor evaluations, description of a conflict situation I resolved, comments from co-workers documentation of leadership
What evidences best demonstrate my leadership skills?	positions held in organizations, description of a leadership role I assumed

Table 1

Terminating Employment

There are many reasons to **terminate**, or leave, a job. Sometimes employees have good reasons for leaving a job; however, often decisions to terminate employment are made hastily and without using sound judgement and decision-making skills. The decision to terminate a job should be made very carefully. When an individual decides to leave a job, he or she should try to leave on good terms with the employer.

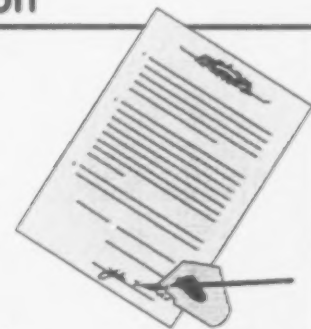
Guidelines for positive termination include the following:

- A notice of intent to leave a job should be given to the immediate supervisor.
- A letter of resignation (a written notice) is preferable and should be prepared if required by company policy.
- Notice of termination should be given soon enough for the employer to find a replacement by the time the job is vacated, if possible.
- It is customary to give at least a two week notice; a four week notice is preferable if paid once a month.
- It is important to keep copies of all correspondence related to employment and termination.

Writing a Letter of Resignation

Tips for writing a letter of resignation include the following:

- State the exact date which you expect to be your last day of employment.
- Thank the employer for his or her help during your employment with the company.
- Give a brief explanation of why you are leaving, unless it is not appropriate due to a dispute, disagreement, etc.
- Write the letter in a business format. Be neat and sincere.



Ethics in the Workplace

⇒ Professional ethics are standards of professional conduct. Ethics may be described as the moral conduct that is expected of all persons working within a profession. It includes the knowledge of right and wrong, confidentiality, and moral behavior.

As employees work, they become familiar with the general rules of conduct in the business world. Employees can maintain ethical standards by following the general policies and procedures of the employer and by remaining loyal, honest, objective, and nondiscriminatory. An ethical employee follows the rules of the establishment and the rules of confidentiality. This means not sharing information about the business or its clients with someone outside of the business. Ethical behavior involves honesty, integrity, and providing equal treatment and service to all.

Utilizing Leadership and Teamwork Skills

Part A:

Directions: Fill in each section below for two opportunities you experienced during the assigned time period to utilize leadership and teamwork skills in problem-solving situations. For example, this may have been through a group assignment at school, an FCCLA chapter activity, a team project at work, or a volunteer activity through your community or church.

Situation #1

Description of the problem-solving situation

My roles/responsibilities as a team member or leader

Leadership and teamwork skills I utilized

Situation #2

Description of the problem-solving situation

My roles/responsibilities as a team member or leader

Leadership and teamwork skills I utilized

Part B:

Directions: Respond to the following statements on the back of this form.

1. Based on the above situations, list three leadership and teamwork skills you think you used effectively.
2. List three leadership and teamwork skills you would like to improve.
3. Briefly state a plan for improving the skills listed in question two.

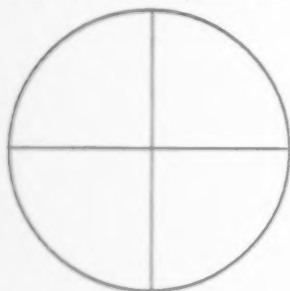
Observations

Problems: Food can become poisonous due to growth of dangerous bacteria.

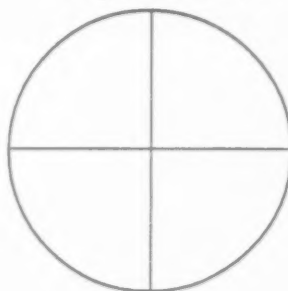
Hypothesis: Improper care and handling of food and failure to follow principles of good sanitation can lead to growth of bacteria.

Observations: Identify the contents of each quadrant on the line provided. Draw a picture or describe the results in each quadrant.

At Room Temperature



Refrigerated at 40°F



Conclusions:

1. The hypothesis is correct. Why?

2. The hypothesis is incorrect. Why?

3. List three rules of good sanitation that can be supported by your findings.
 - a.

 - b.

 - c.

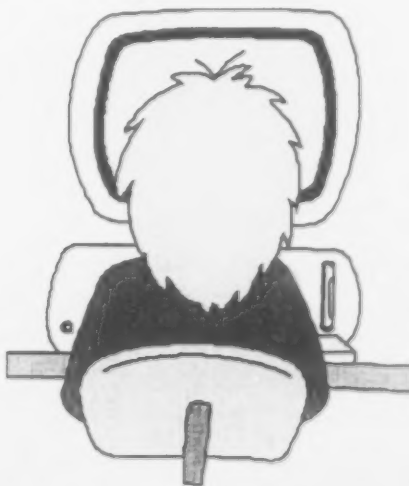
Internet Terminology

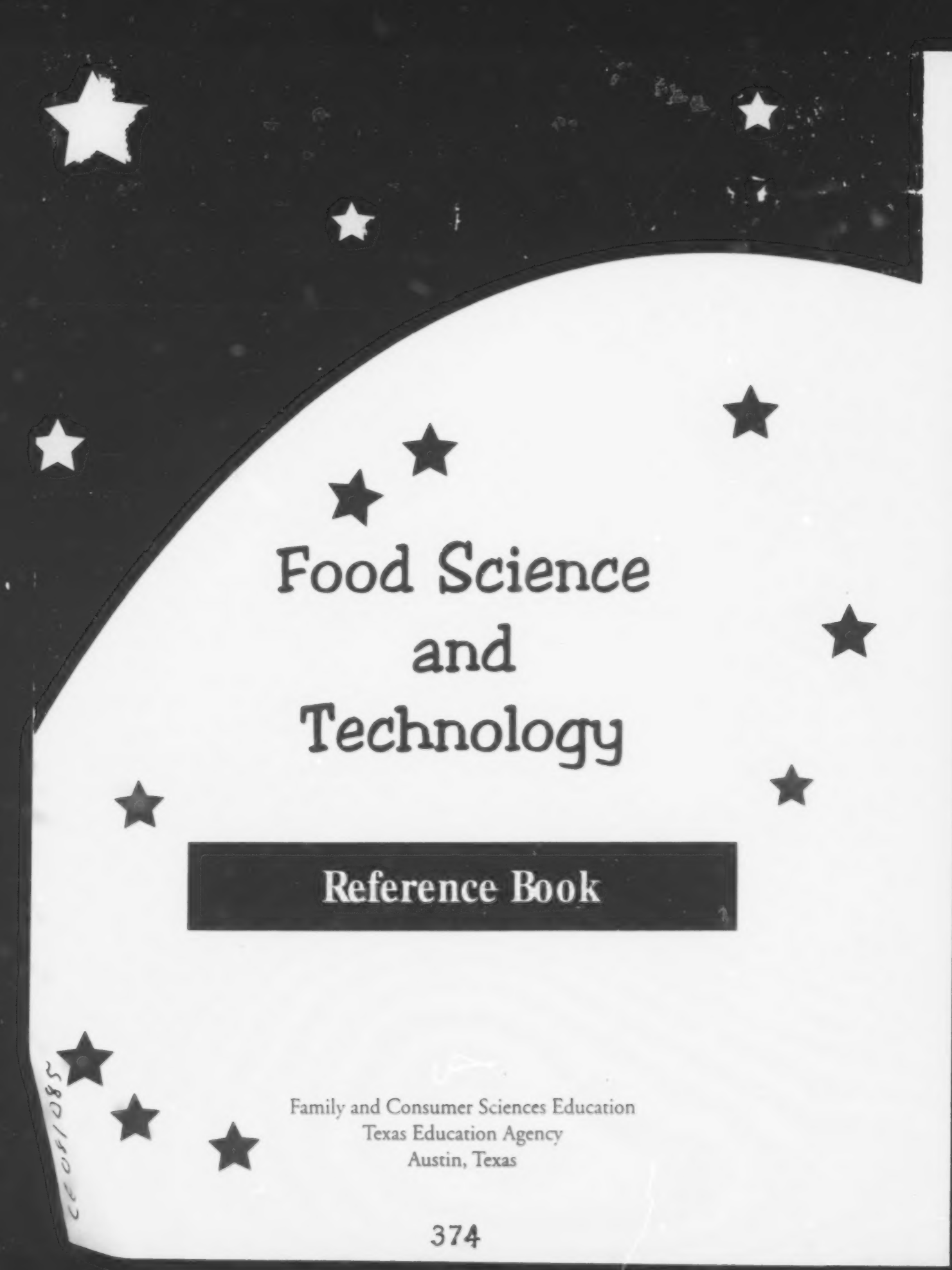
AUP	<i>Acceptable Use Policy</i> ; a written agreement signed by teachers, students, and parents outlining the terms and conditions of Internet use
Bookmarks	a list on your computer of your favorite Web pages
Browser	a special software program used to navigate the World Wide Web
Download	to copy information from another computer (Note: Upload means to send information to another computer.)
E-mail	Electronic mail; exchange of messages with people around the world over the Internet
FAQ	<i>Frequently Asked Questions</i> ; files containing common questions asked and their answers
Home Page	the first page you see when you start your Web browser
HTML	<i>Hypertext Markup Language</i> ; programming language used for creating Web pages
Hypertext	text on a Web page that contains links to other Web pages
Internet	the global computer network that connects millions of computers
ISP	<i>Internet Service Provider</i> ; a company that provides access to the Internet through a phone line
Netiquette	rules of conduct for Internet users
URL	<i>Uniform Resource Locator</i> ; the address used to locate a specific Web page
Web Page	a document stored on a computer that contains information and possibly graphics, sound, and even movies
Web Site	a university, government agency, or company that stores Web pages that you can view
WWW	World Wide Web; an Internet system that offers vast amounts of information

Netiquette

Netiquette is the accepted rules of conduct for Internet users. If you are going to use the Internet, you need to be aware of these rules:

- Always remember that there is a person at the computer on the other end.
- The Internet is not private. Do not type anything that you would not show your boss, your teacher, your principal, or your grandmother.
- DO NOT TYPE IN ALL CAPS BECAUSE THAT IS CONSIDERED SHOUTING.
- Always complete the subject line when sending a message so that the receiver can identify your subject.
- When responding to a message, state what you mean. Avoid just yes or no responses.
- Do not ramble on with your communication. Stay on the subject at hand.
- Never write put-downs. Respect others and their viewpoints.
- Do not copy other people's messages without their permission.
- Avoid obscenities or any offensive language.
- Be careful with humor; others may not be able to tell when you are "just kidding." Use a "smiley" [:)] to show you are kidding.



The cover features a dark background with a large, white, curved shape resembling a stylized 'C' or a protective shield. Scattered around this shape are several white and dark stars of varying sizes. The title is centered within the white area.

Food Science and Technology

Reference Book

Family and Consumer Sciences Education
Texas Education Agency
Austin, Texas

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Food Science and Technology

Reference Book

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Compliance Statement

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

- (1) acceptance policies on student transfers from other school districts;
- (2) operation of school bus routes or runs on a nonsegregated basis;
- (3) nondiscrimination in extracurricular activities and the use of school facilities;
- (4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;
- (5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;
- (6) nondiscriminatory practices relating to the use of a student's first language; and
- (7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, U.S. Department of Education.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

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Chapter 1

Careers in Nutrition, Food Science, and Food Technology



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 13A Determine employment and entrepreneurial opportunities and preparation requirements for careers in nutrition, food science, and technology.
- 13B Compare personal characteristics to those needed for careers in nutrition, food science, and technology.
- 13C Propose short-term and long-term career goals.



Chapter Vocabulary

business plan
capital
career goals
career ladder
entrepreneur
franchise
interest inventory

long-term goals
need
priorities
short-term goals
standards
values
want

CAREERS IN NUTRITION, FOOD SCIENCE, AND FOOD TECHNOLOGY

Careers in nutrition, food science, and food technology offer individuals a wide variety of opportunities. The food industry is the world's largest industry and thus includes exciting career opportunities such as those in

food technology where job responsibilities include the following:

- identifying new food sources
- discovering new preservation methods
- developing foods for space travel
- evaluating and improving food quality
- identifying methods and procedures for food distribution
- developing and testing food additives

- determining standards for food safety
- developing convenience foods
- providing food product and service quality control
- conducting research in food processing
- designing product packaging
- educating the public about food science and nutrition

As a general rule of thumb, higher levels of education and training enable individuals to begin employment higher on a **career ladder** (series of jobs or steps leading to advancement in a career). Refer to Figure 1.1 for an example of a career ladder in food technology.

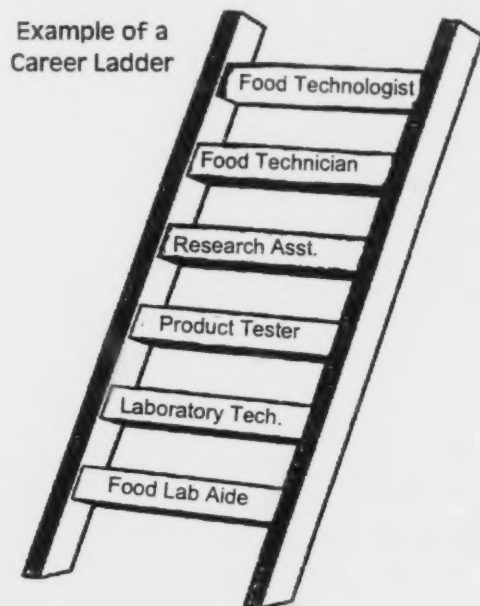


Figure 1.1

Employment Opportunities

Aptitude, skills, interests, and career goals influence the type of career a person selects in the field of nutrition, food science, and food technology. Potential careers include a variety of occupations including quality control manager, hospital dietitian, or food researcher. There also are opportunities in

education, industry, and government. A person can work independently, as a member or leader of a research team, or as the leader of a processing facility.

In industry, a person might work in various areas of food processing, packaging, and marketing or in product development and sales. In education, a person could teach at the high school, college, or university level or be involved in research related to nutrition, microbiology, and food toxicology. Government opportunities include working for government agencies dealing with food supplies, processing, food safety, and inspection. Government agencies involved in food science and technology include the following:

- Department of Commerce
- Department of Defense
- Department of Agriculture
- Department of Health and Human Services

Careers in nutrition, food science and food technology offer opportunities to travel and live in a variety of locations around the world. International organizations offering career opportunities in food science, nutrition, and food technology include the World Health Organization of the United Nations and the Food and Agriculture Organization. Other career opportunities include food scientists, nutritionists, and family and consumer science specialists with expertise in nutrition and food science needed to work in developing countries through the Peace Corps, US AID, and other similar organizations.

Training and practical work experience help broaden an individual's career choices. Further education and professional training help a person progress to another job level or to occupations in management or administration. Both training and experience can increase an individual's potential income.

Table 1.1 represents various occupational opportunities available in the field of food science, nutrition, and food technology.

Career Opportunities in Food Science, Nutrition and Food Technology

Dietetics

- Registered Dietitian
- Therapeutic Dietitian
- Clinical Dietitian
- Educational Dietitian
- Administrative Dietitian
- Consulting Dietitian
- County Extension Agent, Family and Consumer Sciences Educator
- Food Service Manager
- Cafeteria Supervisor
- Restaurant Manager
- Dietitian in Community Nutrition
- Research Dietitian
- Dietitian in Sports Medicine

Entry-level occupational opportunities may involve assisting professionals in the area of dietetics.

Food Science

- Food Scientist/Technologist
- Research Scientist
- Quality Control Manager
- Plant Manager
- Research and Development Supervision
- Production Manager
- Food Ingredient Sales
- Food Chemist
- Food Laboratory Manager
- Process Engineer
- Equipment Designer
- Consultant

Entry-level occupational opportunities may involve assisting professionals in the area of food science.

Human Nutrition

- Nutrition Research Specialist
- Nutrition Consultant, Family and Consumer Sciences Educator
- Public Health Nutritionist
- Food Chemist
- Biochemist
- Food Scientist

Entry-level occupational opportunities may involve assisting professionals in nutrition.

Food Preparation Professional

- Assistant Restaurant Manager
- Restaurant Manager
- Chain Executive
- Personnel Director
- Training Director
- Menu-maker
- Merchandising Supervisor
- Advertising Director
- Recipe Development Director
- Business Manager
- Business Owner

Skilled Workers

- Food Assembler
- Chef
- Cook
- Baker
- Kitchen Supervisor
- Meat Cutter
- Purchasing Agent
- Caterer's Helper

Entry-level Positions

- Kitchen Helper
- Assistant Cook
- Assistant Baker
- Busperson
- Server
- Dishwasher

⇨ Table 1.1

Professional Family and Consumer Science Occupations

Professionals in family and consumer sciences hold bachelor's or graduate degrees in the areas of family and consumer sciences such as nutrition and dietetics; food science and food technology; child development, education, and services; family studies and human services; consumer and resource management; hospitality, textiles and apparel; and environmental design.

A professional certified in family and consumer sciences (CFCS) has successfully passed a national examination. In addition to the professional-level jobs previously identified, there are a variety of family and consumer science occupations that require knowledge and training related to food science and nutrition. A family and consumer science teacher is a professional with at least a bachelor's degree in family and consumer science education. Many instructors teach classes in different subject areas. Family and consumer sciences—also called home economics, human ecology, family studies, or human development—involves using knowledge and skills to solve problems and make decisions about the home and family. These educators teach classes ranging from basic nutrition to food preparation and production for a large facility.

Thus, a basic knowledge of food science and nutrition is necessary for any family and consumer science teacher. Family and consumer science professionals who teach at colleges and universities are usually required to have a master's degree and a doctoral degree (Ph.D. or Ed.D.). In some cases, these teachers specialize in teaching nutrition. These professionals are usually required to conduct research in areas of interest related to their specific teaching fields.

Professionals in family and consumer sciences are hired by the Cooperative Extension Service to teach food and nutrition in

addition to other consumer subjects. These family and consumer science professionals provide instruction in formal settings such as classrooms and in informal settings such as community buildings and homes. They also present radio and television programs, work with organized groups of youth and adults, and develop educational materials. Extension professionals must be well-organized and be able to work well with people. They also should have a thorough knowledge of family and consumer sciences. In most states, county extension agents must have at least a bachelor's degree in one area of family and consumer sciences.

Some companies hire family and consumer science professionals as consultants. For example, a utility company might hire a family and consumer science specialist for a temporary time period to teach classes on food preparation and the use of different types of energy including gas, electricity, microwave, or convection. Such temporary assignments are often called free-lance work. Free-lance work is done by professionals who are not employed on a regular basis but who are hired to complete specific assignments.

Some companies hire family and consumer science professionals as consultants in full-time, permanent positions. Different companies attach different titles to these jobs. For example, a consultant for a food manufacturer might be called a consumer relations representative. This professional responds to customer's questions about the company and its products and services, provide information to customers on food preparation methods, and develop educational materials to promote company products and services. A food service wholesaler might hire a family and consumer science professional as an educational representative to develop and present training programs for retailers who sell the company products. Family and consumer science professionals with training in advertising or communications may be hired

by broadcast media firms, newspapers, advertising firms, and other communications related employers to handle food-related accounts.

There are a variety of organizations, associations, and institutes related to the food science, food technology, and nutrition fields that provide employment opportunities to family and consumer science professionals. In most cases, these professionals represent the organizations and must have poise and the ability to make presentations to groups. Research laboratories in colleges, universities, manufacturing plants, and research centers employ family and consumer science professionals to conduct research related to food science, food technology, and nutrition. These professionals must enjoy working in laboratory settings and be willing to attend to details.

◆ **Essential Questions:** ◆
**Careers in Nutrition, Food Science,
and Food Technology**

1. What is a career ladder and how does it work?
2. What career opportunities are available for family and consumer science professionals?
3. What government agencies employ nutrition, food science, and food technology professionals?

PREPARATION REQUIREMENTS

Food scientists are involved in the physical, microbiological, and chemical aspects of food. They develop new ways to process and package foods we eat. Food scientists test foods and even develop new foods. These scientists work in laboratories and on production lines testing foods to make sure they are fit to eat and meet all government standards.

An individual wanting to become a food scientist should have a minimum of bachelor's degree from a college or university offering studies in food science, nutrition, and food technology. Courses of study include chemistry, biochemistry, microbiology, and physics as well as courses in food technology (including processing, preservation, sanitation, storage, marketing of foods and food products). Courses in business, administration, and economics are beneficial if a career in management or administration is desired.

Food Science Technician. Food science technicians can receive their education and training at various technical training schools, community vocational schools, and many community colleges. Most programs for food science technicians are scheduled to be completed in two years.

Dietitian. A dietitian is a licensed professional helping individuals or groups apply sound nutrition principles to dietary planning. Without certification, dietitians often teach, research diets, or write about nutrition. A registered dietitian (RD) may work for hospitals, private physicians, and institutions that provide foodservice. They develop special diets for individuals and advise groups in making sound nutrition choices.

A person interested in becoming a registered dietitian must have a minimum of a bachelor's degree from an accredited college or university. An accredited college or university must offer a program approved or accredited by the American Dietetic Association. In addition to the course program, a person also must complete a supervised internship as well as pass a national examination to become a certified registered dietitian. The internship can be completed by enrolling in a program that incorporates the academic courses with the internship or by completing the academic requirements followed by an accredited Dietetic Internship of an Approved Pre-professional Practice Program.

Dietetic Technician. A dietetic technician works under the supervision of a registered dietitian (RD) helping patients change unhealthy eating habits and assisting them in making better choices. Dietetic technicians also may teach nutrition and assist in food preparation techniques. To become certified as a registered dietetic technician, a person must have completed an approved two-year program (usually offered at a community college) and pass the national examination.

Chef. A professional chef is a skilled, trained, and experienced manager. The chef is the head cook in the kitchen and coordinates the work of the food production staff. Most chefs are creative artists who control the serving size and appearance of all food served. They plan menus, buy supplies, ensure quality, and check safety and sanitation in the kitchen area. On-the-job training is typical, but formal university or culinary education is available with various specialties.

Restaurant Manager. Restaurant managers supervise kitchen and dining room staff and must train employees in all the tasks and responsibilities related to the foodservice business. Managers are ultimately responsible for quality, food cost, and efficiency for the whole foodservice operation. In a large foodservice operation, managers supervise other managers responsible for specific areas. Education requirements vary depending on the individual's experience and the foodservice establishment.

Director of Recipe Development. Larger restaurants and restaurant chains have directors that create new recipes for their menus. These professionals must have a thorough knowledge of food preparation and the local market. The success of the restaurant chain depends on their abilities to creatively apply the principles of food science and food preparation. A bachelor's degree in any food science area would prepare one for this career.

The cost of any trade school, college, or university can be expensive. Fortunately, many scholarships, grants, and other types of financial aid are available to graduating high school seniors and college students. Financial aid is available to students based on need, scholastic achievement, and an interest in a particular field. Information regarding financial aid is available from individual schools, colleges, and universities.

There are a variety of new food science, nutrition, and food technology career opportunities. Nutrition experts work in the fields of dentistry, physical therapy, and nursing. Food scientists are now employed by water companies, food and drug manufacturers, and food packagers. These careers require a strong science background and at least a bachelor's degree.

◆ **Essential Questions:** ◆
Preparation Requirements

1. What are five areas of career specialization in food science, food technology, and nutrition?
2. What are the educational requirements for most careers in food science, food technology, and nutrition?



Personal Characteristics

Certain personalities and personal characteristics mesh well with careers in nutrition, food science, and food technology. Individuals exploring career options can take an **interest inventory** (a checklist that points to the strongest areas of interest). Interest inventories help individuals identify careers that match personal characteristics. For example, a food technologist may have a natural attraction to science and therefore enjoy researching information and conducting experiments.

Defining interests and personal characteristics by taking interest tests and meeting with the career counselor at school can aid in identifying food science and technology career options that match personal interests and career goals.

ENTREPRENEURSHIP

An **entrepreneur** is a person who owns and operates his or her own business. An entrepreneur usually sells a new product or service. Entrepreneurs are hard workers who believe in the free enterprise system. Free enterprise is the freedom of individuals to organize and operate businesses for profit in a competitive system without governmental interference. Free enterprise is a characteristic of capitalism and the economic system of the United States. Under capitalism, most production means are owned by private citizens. In a free enterprise system, entrepreneurs can earn profits by taking the risk of investing capital or cash in goods used to produce goods or provide services. **Capital** is usually used to buy items such as furniture, equipment, machinery, buildings, fixtures, operating cash, and supplies. The ultimate goal of an entrepreneur is to make a profit. The entrepreneur risks both failing and losing his or her initial investment. Statistics show one out of three businesses fail within the first four years.

Most businesses in the United States are organized as sole proprietorships, partnerships, or corporations. A sole proprietorship is a business owned by one person. A general partnership is a legal business relationship in which two or more individuals share responsibilities, resources, and profits equally. A limited partnership is a legal business relationship in which, according to a written agreement, some owners have a limited liability for business debts and are not involved in the day to day operations of the business. These individuals are sometimes known as silent partners. A corporation is a legal business relationship in which a group of persons join to create an entity treated by law as a separate individual. Through its officers, the corporation makes contracts, conducts business activities, and assumes responsibility for debts.

One primary goal of businesses is to satisfy consumer demand for goods and services. Business functions include production of raw materials, manufacturing, wholesale operations, and retail sale. Small businesses are involved in all functions of business, but they primarily provide products and services to consumers through retail sale. At the retail level, many small businesses are franchises. A **franchise** is a right or license granted to an individual or group to market a company's goods or services. A franchiser grants a franchise and offers a proven market strategy for a product, service, or method. A franchisee is a person or group to whom a franchise is granted. Usually, a franchisee invests capital in exchange for the expertise and widely known product image of the franchiser. Often, the fee includes the cost of inventory with which the franchisee begins business. Many fast-food operations are operated as franchises.

In some cases, entrepreneurs develop an idea for a product or service related to food and nutrition and decide to create a business. It is important for the product or service to be one that is wanted or needed by enough

people that the business can survive and eventually make a profit. Some entrepreneurs start their businesses at home and expand later as the businesses grow. Catering businesses often begin in this manner.

Successful entrepreneurs are usually characterized by the following traits:

- individualism and initiative
- willingness to take a risk
- desire for self-expression
- persistence
- creativity and inventiveness
- technical knowledge of how to operate a business
- ability to survive financially if emergencies occur
- patience to wait until the business becomes successful
- ambition, energy, and drive
- ability to make decisions
- ability to take full responsibility for decisions
- realistic expectations about the amount and types of work required
- ability to communicate

Opportunities for entrepreneurs in food and nutrition include: catering; running a snack shop; home delivery from restaurants or supermarkets; nutrition consulting; and preparing and selling food, such as homemade bakery treats. Launching a business requires responsibility, organization, and a written business plan. Figure 1.2 shows the three components of a **business plan** and the questions to answer when developing a business plan.

Teen entrepreneurs have been successful starting many food-related businesses such as party planning, pizza delivery, and cookie baking. Those who are ambitious and willing to take risks can be successful in starting a business.

◆ Essential Questions: ◆ Entrepreneurship

1. What might be advantages and disadvantages of owning your own business?
2. What personal characteristics contribute to successful entrepreneur business ventures? Give examples. How could a career counselor help?
3. What are business opportunities for entrepreneurs in food science and technology?

CAREER GOALS

Many people go through life without knowing where they are going or how they are going to get there. Setting career goals helps give direction in life. **Career goals** are the aims an individual tries to reach or achieve for their chosen occupational area.

Goals are usually identified by the amount of time it takes to reach them. There are two types of goals: short term and long term. Some goals may take a long time to reach. These are called long-term goals. **Long-term goals** may take months, a year, or many years to reach. Examples of long-term goals include attaining a university degree, working as a researcher in a food science area, or becoming a nutrition expert and teacher.



Basic Parts of a Business Plan

1. **Description of the business.** Will you manufacture a product or perform a service? How and where will your product be manufactured and packaged, or what materials will you need to perform the service you intend to deliver? How did you decide on this product or service? Have you researched how your product or service has developed?
2. **The market of your business.** Who will your customers be? What other businesses are currently providing the product or service you are proposing? Why should customers use your product or service instead of the competition's? How will you price your product or service?
3. **Advertising your business.** How will you advertise your business? How does your advertising plan ensure that you are reaching your targeted customers? Do you plan to do any kind of public relations work in the community? If so, what?
4. **The location of the business.** Where will your business be located? What advantages does this location have? What are the costs of the lease, rent, or purchase of property at this location?
5. **Equipment and materials.** What equipment and/or materials will you need for your office, production area, or service delivery?
6. **Owner information.** What skills and experience do you have that will help you operate your new business? Do you have plans for further training? Do you have sources of information for those times when you need advice?
7. **Financial plan.** A financial plan includes the following:
 - a projected cash flow statement
 - a projected profit and loss statement
 - a balance sheet
 - start-up expenses
 - your personal profit and loss statement

This information takes a great deal of research and development time, but the lending institution will want to be able to see that the groundwork has been laid for the business to produce enough profits to repay the loan.

An entrepreneur may add different types of information, depending on the kind of business that will be financed, the specific requirements of the lending institution, and the business environment in which the business will be located.

Source: *Career Connections Instructional Modules Unit II-3, Entrepreneurship* (1998). Home Economics Curriculum Center.

⇐ **Figure 1.2**

On the other hand, short-term goals may be reached more quickly. **Short-term goals** may be met within a few hours, days, or weeks. Examples of short-term goals include finding a part-time job related to nutrition and food science, volunteering at a local hospital in foodservice operations, or investigating community college programs that offer various food science and technology courses. Setting both short term and long-term goals can be used as tools to achieve success in life.

When setting career goals, individuals should be realistic and specific. A career goal needs to be well defined so that the steps to reach the goal are simple and clear. It is helpful for individuals to assess their interests and become aware of aptitudes, skills, and personality types when investigating career options and setting career goals.

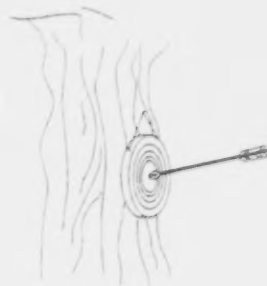
Defining the time frame in which to accomplish short-term and long-term career goals sets the stage for success. Successful large corporations and businesses define what they want to accomplish by setting short-term goals that will help them reach their long-term goals. In the same way, individuals can set short-term goals that will help them accomplish their long-term career goals.

A person can learn about careers in many ways. A potential employee should talk with, and possibly observe, people who are currently working in a field of interest. Discussing likes and dislikes can be beneficial in the job selection process. Working in different areas is an excellent way to evaluate your skills and interests. Career goals are influenced by values, standards, needs, wants, and priorities.

Values are the worth attached to ideas or objects. Values are things that are important to the individual. For example, freedom, honesty, and hard work are highly valued among many families. Values can be held on a personal and family level. Family values may be passed down from generation to generation.

Standards serve as criteria used to evaluate behavior, objects, and feelings. Standards are the characteristics that a family or individual accepts as adequate. Standards often serve as the criteria for reaching goals. For example, one person may feel that a high standard of education is attaining a high school diploma while another may perceive a high standard of education as obtaining a bachelor's or graduate degree from a university.

A **need** is a condition in which something is required for the physical or mental well-being of an individual. A **want** is a condition in which something desirable is lacking. A want differs from a need in that a want is not necessary for survival. Human needs and wants often provide the motivation necessary for survival. Human needs and wants often provide the motivation necessary to begin the management process. For example, shoes are a need, but a pair of designer shoes that cost \$150 is a want.



Priorities are activities or actions that demand attention over other activities or actions. Priorities should be established when setting goals. Individuals must consider what must be done, what should be done, what individuals want to do, and what individuals do not want to do.

The amount of time required to obtain a goal also should be considered. Short-term goals are goals that may be reached in a short period of time. This time period is usually less than one year. Examples include passing an English exam or saving money to buying a new dress. Long-term goals may take several

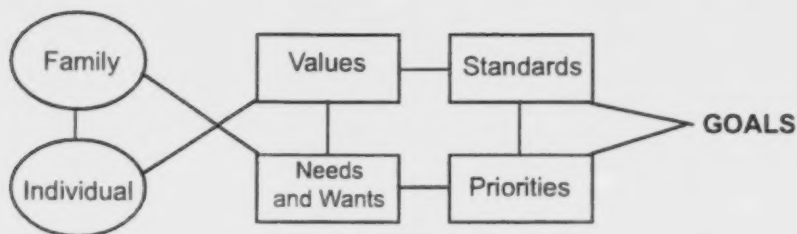


Figure 1.3

years to reach. When prioritizing goals, it is important to make all goals realistic. Figure 1.3 shows how all of these factors influence goals.

Career exploration is a complex process of investigating career options and preparation requirements, and then matching up these components in light of personal priorities. Recognizing the importance of goal setting provides direction, motivation, and focus for a successful future.

◆ **Essential Questions:** ◆
Career Goals

1. What is the relationship between career goals and one's values, goals, standards, and priorities?
2. What are three examples of long and short-term goals?

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Chapter Highlights

- ☆ Careers in food science and nutrition include a variety of occupations with opportunities in education, industry, and government.
- ☆ As a general rule of thumb, higher levels of education and training enable individuals to begin employment higher on a career ladder.
- ☆ Aptitude, skills, interests, and career goals influence the type of career a person selects in the field of nutrition, food science, and food technology.
- ☆ Professionals in family and consumer sciences hold bachelor's or graduate degrees in the areas of family and consumer sciences such as nutrition and dietetics; food science and food technology; child development, education, and services; family studies and human services; consumer and resource management; hospitality; textiles and apparel; and environmental design.
- ☆ An individual wanting a professional food science career should have a minimum of a bachelor's degree from a college or university offering studies in food science and nutrition.
- ☆ Individuals exploring career options can take an interest inventory (a checklist that points to the strongest areas of interest). Interest inventories help individuals identify careers that match personal characteristics.
- ☆ An entrepreneur is a person who owns and operates his or her own business.
- ☆ Opportunities for entrepreneurs in food and nutrition include: catering; running a snack shop; home delivery from restaurants or supermarkets; nutrition consulting; and preparing and selling food, such as homemade bakery treats.
- ☆ Career goals are the aims an individual tries to reach or achieve for their chosen occupational area.
- ☆ A career goal needs to be well defined so that the steps to reach the goal are simple and clear. It is helpful for individuals to assess their interests and become aware of aptitudes, skills, and personality types when investigating career options and setting career goals.

Chapter 2

Skills in the Workplace



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 14A Describe management practices facilitating individuals assuming multiple family, community, and wage-earner roles.
- 14B Practice positive human-relations skills.
- 14E Identify ethical practices in the workplace.



Chapter Vocabulary

accuracy	initiative
code of ethics	management
communication	personal appearance
confidentiality	planning
controlling	positive attitude
cooperation	prejudice
ethics	professionalism
evaluating	resource
honesty	self-control
implementing	stress

American families are in a state of transition. Less than ten percent are families with a full-time homemaker in the home. The growing number of working women, dual-career families, and single parents in society has intensified the need for skills to balance work and family issues. One important workplace skill is that of managing multiple roles. The successful functioning of a working family unit is vital to every family member. Families

must be equipped with a working knowledge of management skills in order to manage multiple roles successfully.





THE MANAGEMENT PROCESS

Management is the act of organizing or supervising activities to obtain results. Management is an effective tool for creating change and reaching desired outcomes. Management skills help individuals use resources to meet work, personal, and family goals. A **resource** is a source of supply or support. Resources include skills, time, energy, knowledge, money, environment, social organizations, and community facilities.

The management process consists of a series of four steps that emphasize the action taken by individuals, families, or businesses to accomplish desired outcomes. In the management process, resources are used to meet demands and reach goals. The steps of the management process are as follows:

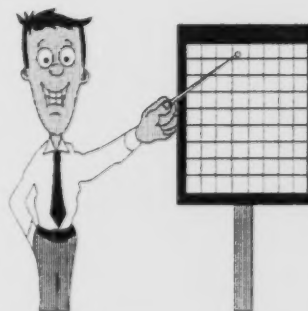
1. Planning
2. Controlling
3. Implementing
4. Evaluating

Planning is the designing of a plan to reach goals. Planning is a significant part of the management process. Therefore, it is important that the planning step be completed successfully. Planning is important for:

- meeting demands
- resolving problems
- reaching goals

The amount of success that is achieved through planning depends upon the completeness, relevance, appropriateness, and flexibility of the plan. A plan should be established by following a specific pattern of action. The following steps should be observed when creating a plan:

1. Identify the goal, demand, or problem.
2. Determine a sequence for the plan. Find a logical order for the tasks, and note the length of time needed to complete each task. Obtain commitments from people involved in the planning process.
3. Organize the plan. Determine which tasks can be grouped together. Identify resources available to reach the goal, meet the demand, or solve the problem.
4. Determine a means for measuring progress. Determine if the plan is progressing as proposed.



It is important to be able to not only recognize the need for a plan, but also to use skills to develop a plan. **Controlling** is the act of supervising plans as they are implemented. Controlling involves comparing the progress of the action to the original plan. The purpose of this comparison is to provide feedback. Feedback can be either positive or negative. Positive feedback shows that the plan is progressing as desired or expectations are being exceeded. Negative feedback identifies possible problems with the plan.

To effectively control plans, individuals need the following characteristics:

- flexibility
- ability to recognize the need for change
- skills to put changes into action

Implementing is the act of putting plans into action. Implementing requires active participation by all individuals involved in the planning process. Implementing a plan requires several different steps. These steps include the following:

- decision making
- physical action
- coordinating

Characteristics needed to implement plans effectively are as follows:

- self-discipline
- work simplification skills
- communication skills
- organizational skills
- self-motivation
- responsibility
- supervision skills

The success of the implementation step depends upon the effectiveness of the original plan, resources available, and the knowledge of roles and tasks.

Evaluating is the process of examining the results of each step of the management process. The evaluation step should not be overlooked because evaluation leads to improved planning, controlling, and implementing in the future. The evaluation step and the controlling step both check the progress and the outcome of a plan, but a more thorough examination is conducted during the evaluation step. The total management process should be checked during the evaluation step. Information received from the evaluation should be used as a means to improve management skills and the success of future plans. Refer to Figure 2.1 for management terms to consider.

◆ Essential Questions: ◆ The Management Process

1. Why is the management process important to learn?
2. What factors should be considered when evaluating the plan of a project?

MANAGING MULTIPLE ROLES

Besides using the management process in the workplace, employers expect workers to manage the many different roles they play in their homes and in the community. All of us perform many different roles. Some roles we perform every day; others are handled less frequently. These roles might include son/daughter, friend, parent, brother/sister, niece/nephew, caregiver, husband/wife, granddaughter/grandson, cook, gardener, lawn mower, housekeeper, or driver. These roles fulfill specific responsibilities and require time commitments.



After identifying all of the roles and responsibilities an individual has, it is important to develop the skills required to effectively manage these multiple roles. There is no right or wrong way to do this, but there are some ways to make the management process more

Management Terms

- ⇒ **Management** is the act of organizing or supervising activities to obtain results.
- ⇒ A **resource** is a source of supply or support.
- ⇒ **Goals** are the aims you are trying to reach or the things you want to achieve.
- ⇒ **Goal setting** is the identification of what one wants to achieve.
- ⇒ **Values** include the worth attached to ideas or objects.
- ⇒ **Standards** are criteria used to evaluate behavior, objects, and feelings.
- ⇒ A **need** is a condition in which something is required for the physical or mental well-being of an individual.
- ⇒ A **want** is a condition in which something desirable is lacking.
- ⇒ **Priorities** are the activities or actions that demand attention over other activities or actions.

⇒ Figure 2.1

effective. Among the points that need to be considered are the following:

- the importance of various roles and why individuals view roles differently
- the impact of the roles and responsibilities associated with one's career on personal satisfaction and well-being
- the effect of the responsibilities associated with each role in one's life
- the constancy of some roles and not others.

How Businesses Help Families Manage Work and Family

For various reasons, one-income families are no longer the norm in the United States. Because of this, the American workplace is changing to meet the needs of its workers. A

study by Hewitt and Associates of more than 1,000 companies in 1999 found that many companies offered programs to help employees balance work and family life needs. This study found that:

- 88% of companies offer employee assistance programs
- 73% of companies offer flexible work arrangements
- 61% of companies offer part-time employment
- 42% of companies offer child care resource and referral
- 37% of companies offer job sharing
- 24% of companies offer compressed work schedules
- 20% of companies offer telecommuting

Workplace policies and benefits can help with the management process. Many companies provide benefits for their employees. These benefits might include health insurance, sick leave, paid vacation, and pension plans. Workers receive these benefits in addition to their salaries at little or no cost.

Companies also may provide benefits commonly referred to as family-friendly benefits. These include flextime (a plan that allows workers to choose when they want to begin and end their workday), flexplace (a plan that allows workers to do their work from home), job sharing (an option whereby two people share one job and split the hours and the pay), and compressed days. For some, flexplace means working at home on a personal computer, using phone, fax, and E-mail to communicate.

Many family-friendly companies offer their employees help with dependent care. An increasing number are providing child care resources and referral services. Some companies help employees by contributing money to support on-site or near-site child care and elder care centers.

Many companies are beginning to offer other family-friendly benefits. These include financial aid for adoption, paid parental leave for new mothers and fathers, phase-back schedule for new mothers, and "set aside monies" that can be tapped by employees for such things as child care costs or part of the down payment on a first home.

More of the formal family-friendly benefits are offered by medium to large corporations. However, small companies often provide informal support that is negotiated on an individual basis rather than a high-cost benefit package.

Government Support of Work and Family Programs

The Family and Medical Leave Act was signed into law by President Clinton in February 1993. Because the law applies only to businesses with fifty or more workers, about 95 percent of all employers in the United States are exempt. However, for the 5 percent subject to the law, the federal legislation allows workers to take up to twelve weeks of unpaid leave during any twelve-month period because of the birth or adoption of a child, the worker's own serious illness, or the need to care for a child, spouse, or parent with a serious health condition.

The law applies to employees who have worked for the same employer for at least one year and for at least 1,250 hours that year. By the same token, the law allows employers the right to deny leave to a worker who falls among the highest paid 10 percent of workers if that person is considered a key employee whose leave would result in "substantial and grievous economic injury to the business." Many companies with a family-friendly culture grant employees a paid leave or negotiate with the employee to create a leave package that combines vacation, sick days, and unpaid time.

◆ Essential Questions: ◆ Managing Multiple Roles

1. What are the many roles an employee might have?
2. How do some companies help employees manage responsibilities at home?
3. What is flex time? Give an example.

MAKING IT WORK IN YOUR LIFE

One way to tackle the challenge of managing multiple roles is to make a personal commitment to assume responsibility for making life management decisions. To successfully meet this challenge, individuals can learn management skills in order to effectively coordinate work, home, school, family, community, and leisure activities. In this quest to have a more manageable life, an inventory of priorities and roles is necessary. Training in time management, money management, stress management, and role sharing can aid in the "life" management process.

Time Management

Time is a special resource, but it is also a limited commodity. There are only sixty minutes in an hour, twenty-four hours in a day, seven days in a week, and fifty-two weeks in a year. Time management skills can help individuals reach their goals. On the other hand, difficulties with time management have been identified as one of the key barriers to successfully managing multiple roles.



Regardless of schedules and how many hours are actually worked, it is important to be sensitive to time. Take a realistic look at how time is spent in a day. Include tasks related to homework, after-school activities, household chores, church activities, and part-time jobs.

The basic management rules of planning, prioritizing, scheduling, and implementing

help most of us most of the time. One important rule to remember is to avoid procrastination. Unfortunately work does not magically disappear, so try not to put things off.

The following are time management tips:

- Be flexible.
- Schedule energy and rest breaks into the day.
- Set goals and stick to them.
- Reward yourself along the way.
- Take "joy" breaks.
- Don't feel guilty when saying "no" to other activities.

Money Management

The family is the basic informal economic unit of the American culture. Because of this, money management skills are a critical aspect of everyday life at all stages of the family life cycle. Whether single or married, children at home or living on their own, work and money play important roles in our lives and have a large influence on family relationships.

It is a good idea to look at where money goes in the family unit. There are four basic steps that can help family financial management:

1. Keep records of spending for at least two months. This will give an accurate picture of spending habits.
2. List fixed expenses, e.g., rent or house payments, car payments, college loan repayments, credit card bills, insurance, and taxes.
3. Determine your flexible expenses, such as food, clothing, and entertainment.
4. Balance the expenses (fixed and flexible) with the available income.



The Consumer Credit Counseling Service provides free budget counseling and offers debt repayment planning as well as consumer education to families concerned about money management.

Stress Management

Stress is frequently associated with a busy lifestyle. Experts report that many mothers and fathers expressed "lots of stress" in balancing their family and work roles. Many families report an increased stress level in the past ten years.

Most individuals are familiar with stress. It is important to recognize that what is stressful to one person may not be stressful to another. Nor is all stress bad or bad for you. On the other hand, striving to be your best—as a parent, professional, student, or friend—can trigger stress.

Stress is defined as the way individuals react to change in their lives. It is normal and positive when an individual identifies the source of stress and a goal or challenge is met. However, when the source of stress is unclear or uncertain, or if several stressors exist at the same time, then stress can become negative.

Medical experts now believe that between 50 percent and 80 percent of all illnesses are closely associated with—or even caused by—excessive or poorly handled stress. Unfortunately, when stress is denied, it is likely to come out in physical symptoms such

as headaches, diarrhea, or chest pains. Because it is unlikely that anyone can escape stress, an individual needs to find the right balance. Learning to cope with life and controlling the response to stress will help employees be successful in managing multiple roles in the workplace and at home. Refer to Figure 2.2 for ways to reduce stress.

Role Sharing Strategies

Today's employment patterns can cause role overloads and strains in many households. Pressures escalate when there is too much to do and too little time in which to do it. In general, there are typically three possible solutions for the overload problem:

1. Have family members share the total workload at home.
2. Lower standards regarding the household tasks.
3. Hire outside help.

Unfortunately, there are no easy solutions to the complex task of sharing roles and responsibilities in a family. Each family must work out its own combination of suggestions and remedies in order to juggle work and family responsibilities.

Ultimately, however, the effectiveness of sharing the overall workload depends upon the attitudes and actions of everyone involved. The allocation of duties among family members needs to be discussed and negotiated.

These interactions may result in different patterns of role sharing as the family grows, as the work schedules change, and as the family moves through various stages of the family cycle. Successfully managing family and work is a skill that will help facilitate employee effectiveness in the workplace of today.



Stress Busters

Analyze your stress. →

Ask yourself the following: How stressed do I feel? How important is the event or situation that is causing me the stress? (A "must do" activity is very different from something that might be "fun to do", but not really essential.)

Seize control in small ways. →

Take time to achieve order whenever you can. Straighten up your desk (or your room). Get rid of unnecessary clutter.

Develop a positive attitude and practice positive thinking. →

Remind yourself of your success and do so frequently. Create a few positive sound bites that you can play in your mind. These might be, "I am really good at organizing events," or "I worked hard and I earned that A."

Take one thing at a time. Stop worrying. →

Whenever you begin to fret about what might happen, stop! Do not jump to conclusions. Be patient and see what happens.

Prioritize. →

Simplify your life. Do not try to do it all. Share your tasks with others in your family and prioritize tasks in order of importance and deadlines.

Be your own best friend, and be nice to yourself. →

Exercise, eat right, and get plenty of rest. Find a hobby or activity that is relaxing.

Keep a stress diary. →

Start a journal in which you:

- describe what makes you tense and stressed out;
- identify how you feel and what you really think about the situation or event that triggered the stress; and
- decide what you can do about the stress.



⇒ **Figure 2.2**

◆ **Essential Questions:** ◆
Making it Work in Your Life

1. How is the ability to manage multiple roles important in the workplace?
2. What issues are necessary to address when solving the problem of juggling too many roles and responsibilities?

PERSONAL CHARACTERISTICS

Finding a job that offers personal satisfaction, adequate wages, and opportunities to learn and advance is a major accomplishment. It takes time and effort not only to look for a job but also to keep a job. In order to become a successful employee, individuals must possess qualities desired by employers as well.

There are many characteristics or qualities that employees need in any job in order to be successful. Employers look for these personal traits when people apply for jobs. Employers also consider these qualities when evaluating employees after they are hired. A person's failure to keep a job is often due to a lack of desirable personal qualities rather than a lack of job skills.

Personal qualities can be developed and improved if a person makes a sincere effort. Honest self-evaluation helps a person determine strengths and weaknesses. Honest self-evaluation and self-improvement often leads to employment success. Each work experience helps an individual strengthen his or her interpersonal qualities and prepares him or her for future employment and a productive personal life.

Positive Attitude

A **positive attitude** is a way of acting, feeling, or thinking in which an individual shows a favorable mood or outlook. There-

fore, a positive work attitude involves thinking about work in a favorable manner. It is easier for a person to secure and keep a job if he or she has a positive attitude. An employee expresses a positive attitude by showing enthusiasm and willingness to learn. Enthusiastic employees are more productive than employees lacking enthusiasm for work. They concentrate on the positive attributes of a job as well as the positive attributes of other people.

It is also important for an employee to develop an attitude of loyalty to his or her employer. A loyal employee follows the rules and policies of a business, and she or he is concerned with the quality of work and services provided.

Employees should avoid gossiping about other employees and supervisors since negative comments about other people tend to cause individuals to develop negative impressions of the persons discussed. When a person develops a negative attitude, it is often difficult for him or her to be open-minded and fair toward other people.



Having a positive attitude toward co-workers helps to maintain a pleasant work environment. The ability to get along with others influences success in any job. A friendly, sincere manner, willingness to do one's share of the work, and respect for the knowledge and skills of other employees helps provide good relationships.

Positive attitudes toward the employer, other employees, and the job help a person to deliver high-quality performance. In addition, a positive attitude can lead to promotions. A highly skilled employee who is negative and uncooperative may not be as valuable to a company as an average skilled employee who is positive, enthusiastic, and eager to learn.

There is no substitute for hard work in obtaining job success. A person with a positive attitude

- is friendly
- smiles often
- adapts easily to change and new ideas
- is considerate of others
- accepts responsibility
- is happy
- has an optimistic outlook on life
- is cooperative
- keeps complaints to self
- is not critical of others
- sees most criticism as constructive

A person with a negative attitude

- is unfriendly
- frowns or rarely smiles
- resists or refuses to change or accept new ideas
- is inconsiderate of others
- is unwilling to accept responsibility
- complains to everyone about everything
- is critical of others
- is disgruntled
- has a pessimistic outlook on life
- sees all criticism as destructive

Self-Control

Self-control is the ability to be in control of one's own emotions and actions. There are times in any job situation when problems occur and it may be difficult to remain calm. However, a successful employee must keep his or her temper under control and avoid unpleasant confrontations with co-workers, supervisors, and other individuals.

An individual can develop self-control by maintaining a pleasant disposition. Pausing to think before speaking or taking rash actions also helps a person to control himself or herself. Learning to remain calm in difficult situations is an important trait for any employee. Working hard to perform well and obtain the respect of supervisors and co-workers makes self-control easier. A person should learn to accept constructive criticism and

remain friendly. These practices help a person develop a pleasant temperament.

Initiative

Initiative is the ability to think and act without being prompted. An employee with initiative is willing and has the ability to observe tasks that need to be done and complete them without being told to do so.

A willingness to learn is also a sign of initiative. The employee who is eager to learn will ask about opportunities for growth and learning. Employers recognize initiative by giving increasing responsibility to those employees who show an interest in opportunities to learn new skills.

Cooperation

Cooperation involves a willingness to listen to other people's views and opinions and to work toward common goals. Employees should become familiar with and follow the rules and policies of their employers. Willingness to complete all assigned tasks with a positive attitude is another characteristic of a cooperative employee.

Even if personality problems exist between two employees, it is important for both individuals to avoid petty differences and work together as well as possible. Willingness to cooperate with co-workers and supervisors without insisting on doing things a particular way contributes to a positive work environment for everyone.

Honesty

Honesty means being trustworthy, fair, and sincere. Employers expect employees to show honesty by maintaining high ethical standards, telling the truth, and handling the employer's possessions with care. Dishonest behavior includes stealing from a company and using company property for personal use.

The most common item employees steal from employers is time. Employees who report to work late, take extra time at breaks and lunch, leave work early, make personal phone calls, remain idle, and visit with other employees are using time for personal use that should be spent working. An employee should show honesty by providing the employer with a full day's work in exchange for wages. Dishonest behavior is a common reason employees are dismissed.

Accuracy

Accuracy is the condition of being thorough, exact, and free of mistakes. An employer expects employees to perform work accurately since accuracy is following procedures correctly without supervisors having to repeat instructions.

The ability to follow instructions exactly as the procedure manual outlines or as the supervisor directs is important to a company's productivity. In addition, employees are often evaluated on their ability to follow instructions and perform tasks accurately. Paying attention to details rather than being careless in one's work habits helps develop accuracy.

Communication

Communication is the giving and exchanging of information. Information such as ideas, data, and instructions is exchanged in the workplace daily. Therefore, the ability to communicate effectively with other people is important in succeeding on the job.

Skills necessary for effective communication include listening, speaking, reading, and writing. It is also important to learn to pronounce words correctly, use correct grammar, and become familiar with terms used in a particular job setting. Employees must be able to use these skills to send and receive messages that can be understood clearly.

Personal Appearance

Personal appearance, or the way a person looks, is an important factor in achieving job success. An individual's appearance affects the way others react to him or her and influences how an individual feels about himself or herself. People enjoy being around neat, well-groomed individuals. Individuals with messy appearances are often perceived as being insensitive and uncaring. Appearance also is important since it is often the first impression people have of an individual.

All employees benefit from having a good appearance, but it is especially important for employees who come in contact with the public to have a professional and neat appearance. To develop a positive and pleasing appearance, a person should use the following guidelines:

- Check clothing and general appearance before going to work.
- Make needed repairs to clothing on a regular basis.
- Choose clothing that is appropriate for the employment situation.
- Select clothing that fits properly.
- Have hair cut or trimmed on a regular basis in an appropriate style.
- Wash hair as needed to maintain cleanliness, and style hair daily.
- Apply moderate amounts of makeup to a clean face, if female.
- Shave and/or neatly trim beard or mustache, if male.
- Make regular visits to the dentist.
- Maintain fresh breath and clean teeth by brushing, flossing, and practicing dental hygiene.
- Keep hands cleaned and nails well manicured.
- Take a bath or shower daily and use a reliable deodorant.
- Select sensible shoes that are clean and in good condition.
- Maintain proper posture when sitting, standing, and walking.
- Make a habit of smiling.

Professionalism

Professionalism is competent behavior that is of a high standard or status. Professional behavior is exhibited when an employee's performance is above the standards set for tasks, when the employee is loyal and respectful to superiors, and when the employee is considerate of co-workers.

Professional dress also is important in creating a professional image. An employee is more likely to gain the respect and attention of co-workers, supervisors, and others when she or he is well-groomed and wears clean clothing appropriate for the job.

Professionalism involves not only professional behavior but also professional growth. Membership and active participation in professional organizations are indications that an employee is interested in the profession and in personal and professional improvement. Publications from professional organizations provide current information on various aspects of a field. The information professional publications provide varies according to the field in which one is employed.

Professional growth also can be obtained by participating in continuing education programs offered in the workplace or by local educational institutions. Many professional organizations offer certification courses in which employees are trained according to specified requirements set forth by the organization.

Employees should strive to achieve professionalism since it often prepares them for advancement into positions requiring higher levels of skill. Employers look for the following in their employees:

- interpersonal skills
- teamwork skills
- analytical skills
- oral communication skills
- flexibility
- computer skills

- written communication skills
- leadership skills
- work experience

◆ Essential Questions: ◆ Personal Characteristics

1. What is professionalism?
2. How does communication affect job performance?
3. What personal characteristics are important and desired by employers?

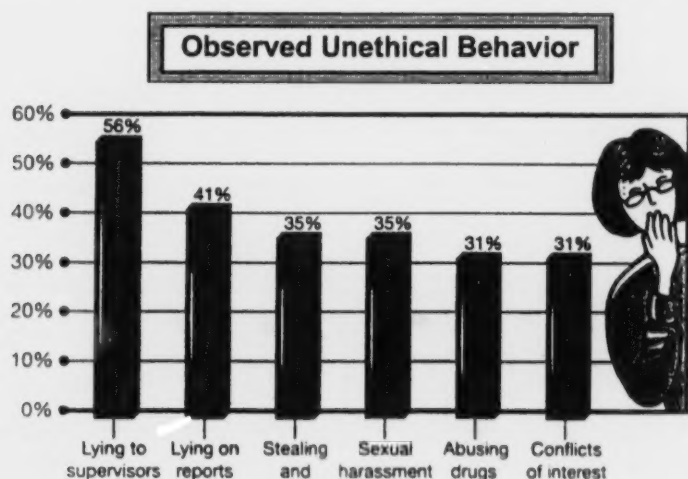
ETHICS IN THE WORKPLACE

Ethics are standards of professional conduct or the moral conduct that is expected of all persons working within a profession. Simply put, ethics involves learning what is right or wrong and then doing the right thing.

Philosophers have been discussing ethics for at least 2500 years and consider ethics to be the "science of conduct." Current research shows that 90 percent of business schools now provide some form of training in business ethics, and some 76 percent of corporations surveyed have a code of ethics.

What is a code of ethics? A **code of ethics** details specific policies, procedures, and practices which are considered "non-negotiable" for individuals working within a profession. A code of ethics contains the dos and the don'ts or the rules and expectations for the workplace.

Many organizations and businesses have a code of ethics to set the standards and rules of professional practice or behavior established by the group. For example, the American Dietetic Association and its credentialing agency, the Commission on Dietetic Registration, believe it is in the best interest of the profession and the public it



Source: Flynn, Gillian. "Make Employee Ethics Your Business." *Personnel Journal*, June 1995, p. 30.

Figure 2.3

serves to have a "Code of Ethics" in place that provides guidance to dietetic practitioners in their professional practice and conduct. This document outlines commitments and obligations of the dietetics practitioner to client, society, self, and the profession.

ETHICS

Rules, standards, codes, or principles which provide guidelines for morally right behavior and truthfulness in specific situations.

Unethical Behavior

Studies show that there is a problem with ethics and honesty in the workplace today. Many employees are dishonest about the time spent on the job. Their bosses trust them to put in the time required to complete a job, but often the time actually spent doing a job is much less than what is reported.

Often, money is involved in many unethical practices. Petty cash is stolen, more than the allowance for food and travel is spent on expense accounts, bids are awarded to certain companies who provide illegal or unethical rewards (gifts, free lunches, trips), and many other dishonest practices can occur in the workplace.

Other issues dealing with unethical behavior fall in the "unfair" category. Prejudices and unfair treatment of employees or customers are ethical issues. Ethical behavior by employers and employees requires fairness to all.

A recent study by the Ethics Resources Center revealed that one-third of employees interviewed observed some kind of unethical behavior during a one-year period. Figure 2.3 shows statistics regarding unethical behavior observed in the workplace.

Confidentiality

Employees may have privileged or confidential information about new products or plans to expand in new markets. This information is central to the success of the

business and a "leak" of this information to a competitor could harm the company. A business will expect employees to observe **confidentiality**. Confidentiality is defined as the assurance that someone can be trusted with private or classified information. Often employers expect employees to handle privileged information confidentially.

Fairness

A common goal of all businesses is to be fair to customers and co-workers. Everyone involved in an organization deserves to be treated openly, honestly, and fairly.

Prejudice is a negative prejudging attitude toward a person or group. Prejudice can be hurtful and offensive and is always unacceptable in the workplace. Employees can be fired or sued for prejudiced behavior. Some examples of this intolerable behavior are racist or sexist comments, stereotyping, name calling, and rude gestures.

Regardless of the occupation, employees are faced with ethical and moral dilemmas at work. It may be confusing trying to determine right and wrong in some situations.

Questions concerning ethical matters are not always clear-cut. It may be necessary to involve others whom you trust and seek expert counsel. Use the best judgment. Figure 2.4 outlines questions to help sort out ethical dilemmas. Knowing what behavior is ethical, what is right, and what is wrong is crucial knowledge in today's workplace.

Ethics Quiz

- ✓ Is it against the law?
- ✓ Is it wrong?
- ✓ Is it against company policy or rules?
- ✓ Will you feel bad if you do this?
- ✓ If this were reported on the news, what would the viewers think?
- ✓ Would a child say this action was right or wrong?

Source: Flynn, Gillian. "Make Employee Ethics Your Business." *Personnel Journal*, June 1995, p. 30.

➡ **Figure 2.4**

◆ Essential Questions: ◆ Ethics

1. What is a code of ethics and how is it used in business?
2. How can one determine if an action is unethical? Give examples.



Chapter Highlights

- ☆ The growing number of working women, dual-career families, and single parents in society has intensified the need for skills to balance work and family issues. One important workplace skill is that of managing multiple roles. Families must be equipped with a working knowledge of management skills in order to manage multiple roles successfully.
- ☆ Management skills help individuals use resources to meet work, personal, and family goals. The steps of the management process are planning, controlling, implementing, and evaluating.
- ☆ Many companies provide benefits for their employees. These benefits might include health insurance, sick leave, paid vacation, and pension plans.
- ☆ The Family and Medical Leave Act was signed into law by President Clinton in February 1993. This federal legislation allows workers to take up to twelve weeks of unpaid leave during any twelve-month period because of the birth or adoption of a child, the worker's own serious illness, or the need to care for a child, spouse, or parent with a serious health condition.
- ☆ Time management skills can help individuals reach their goals. On the other hand, difficulties with time management have been identified as one of the key barriers to successfully managing multiple roles.
- ☆ Stress is defined as the way individuals react to change in their lives.
- ☆ An employee expresses a positive attitude by showing enthusiasm and willingness to learn. Enthusiastic employees are more productive than employees lacking enthusiasm for work.
- ☆ Self-control is the ability to be in control of one's own emotions and actions. Learning to remain calm in difficult situations is an important trait for any employee.
- ☆ Professional behavior is exhibited when an employee's performance is above the standards set for tasks, when the employee is loyal and respectful to superiors, and when the employee is considerate of co-workers.
- ☆ Ethics are standards of professional conduct or the moral conduct that is expected of all persons working within a profession. A code of ethics details specific policies, procedures, and practices which are considered "non-negotiable" for individuals working within a profession.

Chapter 3

The Nutrient Team



Chapter Focus

The following Essential Knowledge and Skill is discussed in this chapter:

1A Describe the functions of nutrients in the body.



Chapter Vocabulary

amino acids

analogues

carbohydrates

complete proteins

enrichment

fat-soluble vitamins

fortification

incomplete proteins

insoluble fiber

lipids

nutrient dense

nutrition

nutrification

proteins

soluble fiber

vegetarianism

water-soluble vitamins

NUTRITION

Nutrition is the process of nourishment. It involves the conversion of substances in food into the nutrients the body needs for daily functioning and maintaining health and wellness. The statement, "You are what you eat," is certainly true from the standpoint of nutrition and good health.

The study of nutrition is a science that involves the relationship of growth, development, and overall health to the intake of

nutrients. Individuals need to have basic knowledge of nutrition so they can select foods that promote good health and separate fact from fallacy in health and nutrition claims.

In your body, nutrients work together as a team. Each nutrient has its role, with some playing a more major role than others. All nutrients are essential to good health.

Nutrients are life-sustaining substances that nourish and promote the growth of the human body. The six nutrient groups include the following:

- proteins
- carbohydrates
- fats
- vitamins
- minerals
- water

Some nutrients supply energy to the body (proteins, carbohydrates, and fats), but all nutrients help build cells and tissues. Nutrients also regulate body functions such as breathing.

No one food contains all of the nutrients necessary for the body to function effectively; therefore, a balanced diet that incorporates appropriate amounts of the six nutrients, as well as recommended servings from the basic food groups, is necessary. Individuals should choose foods of high nutrient density rather than foods with empty calories. Foods that are **nutrient dense** are foods that are excellent sources of essential nutrients with few, if any, empty calories. Foods with empty calories provide calories or energy but little or no nutritive value. Figure 3.1 shows the USDA's suggested daily servings from the basic food groups.

PROTEINS

Proteins are needed for growing and forming new tissue; maintaining and repairing tissue; forming enzymes, hormones, and antibodies; providing energy; and regulating bodily processes. The amount of protein needed by each individual is influenced by the following:

- age
- body size
- physical state
- quality of the proteins ingested

The Basic Food Groups

Meat, Poultry, Fish, and Alternates

(eggs, dry beans and peas, nuts, and seeds)

Servings: 2-3

The meat group or protein group is made up of eggs, peanut butter, and all types of meat including beef, poultry, pork, lamb, and fish.

Fruits

Servings: 2-4

The fruit group is made up of all fruits including, apples, bananas, oranges, grapefruits, melons, and berries.

Vegetables

Servings: 3-5

The vegetable group includes all vegetables including broccoli, spinach, squashes, carrots, and lettuce.

Breads, Cereals, and Other Grain Products

Servings: 6-11 (Include several servings of whole-grain products daily.)

The bread and cereal group includes bread, cereal, rice, and pasta.

Milk, Cheese, and Yogurt

Servings: 2

The milk group includes all types of milk, cheese, and yogurt.

Fats and Sweets

Servings: none

Avoid too many fats and sweets.
Avoid alcoholic beverages.

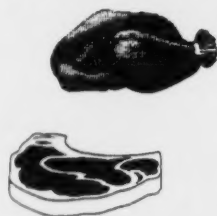
Source: Adapted from "Preparing Foods and Planning Menus," Home and Garden Bulletin No. 232-8, U.S. Department of Agriculture Human Nutrition Information Service, U.S. Government Printing Office: Washington, D.C., p. 11.

Figure 3.1

The structural units of protein are called **amino acids**. Amino acids can be found in every cell of the body. These amino acids can be broken down into two categories: essential and nonessential. Essential amino acids must be provided in the diet. The body cannot produce essential amino acids sufficiently to meet the body's needs. Nonessential amino acids can be produced by the body in adequate amounts and do not need to be added to the diet.

Sources of proteins are animal food products and plant food products. Animal food products are the best sources of proteins because they supply all of the essential amino acids needed by the body. Because they supply all of the essential amino acids needed by the body, they are called **complete proteins**. Sources of complete proteins include the following:

- meat
- milk
- cheese
- eggs
- poultry
- fish



Plant food products supply many amino acids, but they do not contain all of the necessary amino acids. Plant food products are considered incomplete proteins. **Incomplete proteins** do not contain all of the essential amino acids needed by the body. Plant food products include the following:

- cereals from the various grains
- vegetables
- fruits
- legumes (dried beans and peas)
- nuts

Eating an animal source of protein or combining certain plant protein sources daily gives a person a good supply of needed proteins. The availability of protein varies in different parts of the world. In the United States, the supply of animal protein is in excess of the amount needed. In countries such as India, Iran, Pakistan, and Egypt, the supply

of animal protein is limited while there is an abundance of plant protein available. Therefore, their diets are based on legumes, cereal grains, and tubers. Sugar, which has no protein, is the main source of calories in some countries. In countries such as Africa and Brazil, the main dietary food is cassava meal, which contains only 1 percent protein. Whether animal or plant protein is consumed by a particular country or culture is largely dependent upon the type of protein available to the consumer.

Religious and cultural beliefs also influence a person's diet. Some societies do not believe in killing or eating animals. These societies practice **vegetarianism** or eating foods of vegetable origin and none of animal origin. Others are allowed to eat only meat of animals that are killed under certain conditions.

Individuals who choose not to eat animal protein must eat other foods or combinations of foods that will provide adequate protein in their diet. It is possible to combine two products with limited amino acids (or incomplete proteins) in the right amounts to produce the equivalent of an essential amino acid, thus providing the diet with adequate protein. Examples of foods with incomplete protein or vegetable protein foods include legumes, nuts, seeds, whole grains, and vegetables. Examples of these foods are included in Figure 3.2.

Example combinations of foods with incomplete proteins that when eaten together produce the equivalent of complete proteins include the following:

- legumes and rice
- whole wheat bread and peanut butter
- nuts and legumes
- lentils and rice
- beans and corn (bean taco or burrito)
- leafy vegetables, legumes, and cereals
- milk and cereals
- macaroni and cheese

Incomplete Protein Foods

Legumes

dried beans
dried peas
dried lentils
peanuts
soybeans or soy products



Seeds and Nuts

sesame seeds
sunflower seeds
walnuts
cashews

Whole Grains

barley
oats
rice
pasta
cornmeal
whole-grain breads



Figure 3.2

Soybeans are the most widely used substitutes for animal protein because of their high protein content. The soybean has become an important component of the American diet with its use in cooking oils and margarine and in the meat and poultry industries. When used as a milk substitute, soy milk must be fortified with calcium and is often fortified with B₁₂ and other vitamins and minerals. Without this fortification, the milk has only 25 percent as much calcium as regular cow's milk. Before purchasing soy milk, the consumer should make sure the product has been fortified with minerals and vitamins.

Soy concentrate is a protein concentrate of approximately 70 percent. It is formed through a process which extracts all of the oil and most of the soluble carbohydrates from the soybean. This soy concentrate can be processed into a granular form and used in

other foods such as ground meat products, snacks, cereals, baby foods, and sausage products.

Soy protein can be blended with other vegetable proteins as well as carbohydrates, minerals, vitamins, fats, flavors, and colors to form products that look and taste like real meat, fish, and chicken products. These products, called *analogues*, contain about 50 percent protein. This percentage of protein is higher than that of real meat, which only contain 15 to 30 percent protein. Ingredients typically used in food analogues include the following:

- vegetable proteins such as wheat gluten and soy
- corn, cottonseed, and soybean oils
- water
- oats
- salt
- rice starch
- modified corn starch
- stabilizers
- emulsifiers
- onions
- garlic
- minerals
- vitamins
- colorings
- flavors
- fats
- carbohydrates

Plant foods are usually high in fiber. The fiber may affect the body's ability to digest the plant protein found in vegetables. This can make it more difficult to consume adequate protein levels. Most plant foods are not only high in fiber but also low in calories. If a person does not consume enough calories, the body must rely on protein to provide the body's energy supply. A diet sufficient in protein but lacking in calories results in a diet that is insufficient in protein as well. Sufficient calories must be included in the diet to keep this from happening.

Another problem can occur when a person does not eat animal protein. A lack of foods from animal origin may result in a deficiency of vitamin B₁₂. Vitamin B₁₂ is found only in foods of animal origin. Individuals who do not eat animal protein need to supplement their diets with vitamin B₁₂.

When planning a diet that does not incorporate animal proteins, the following guidelines are important to remember:

- Supplemental plant proteins must include a wide variety of legumes, nuts, whole grains, or imitation meats processed from soybean or other plant proteins.
- Two to three servings of milk or milk products should be included in the diet. If no animal products are consumed, fortified soybean milk and a B₁₂ vitamin supplement should be included.
- Legumes such as dried beans, lentils, peanuts, and soybeans; seeds such as sesame and sunflower; and green leafy vegetables such as broccoli, turnips, or spinach should be eaten daily to replace a lack of calcium that milk or other dairy products would provide. A cup of broccoli, turnips, or spinach has the same amount of calcium as a cup of milk.
- Large quantities of fiber should not be added. Sufficient amounts are already available in the vegetarian diet.
- Citrus fruits, which are sources of vitamin C, and dark green leafy or yellow vegetables, which are sources of vitamin A, should be eaten daily.

◆ **Essential Questions:** ◆
Proteins

1. What factors influence the amount of protein needed by individuals?
2. What is the difference between complete and incomplete proteins?
3. What are analogues?

CARBOHYDRATES

Carbohydrates furnish most of the energy needed by the body to move, perform, work, and live. Carbohydrates also help the body use fats efficiently and provide bulk or fiber to the body. If the amount of carbohydrates available to be used for energy is insufficient, the body will get energy from its fat and protein resources. This keeps protein from performing its other more important functions. Carbohydrates come in three forms:

- sugars (simple carbohydrates)
- starches (complex carbohydrates)
- cellulose (complex carbohydrates)

Starches and sugars are the body's main supply of energy. About half the calories eaten should come from carbohydrates. The dietary guidelines recommend that only 10 percent of carbohydrates come from sugar. Cellulose supplies bulk to the body.

Carbohydrates can be classified into three categories: monosaccharides, disaccharides, and polysaccharides. Monosaccharides are the simplest form of carbohydrates. The monosaccharides are glucose, fructose, and galactose. These monosaccharides can be found in the following foods:

- Glucose is found in fruits, corn, and corn syrup. It is also known as blood sugar. It is the by product formed after the more complex carbohydrates have completed the digestion process.
- Fructose is in honey and fruit. Fructose also is known as the most concentrated and sweetest of all sugars.
- Galactose is not found in nature, but it is derived from the breakdown of lactose.

Disaccharides are double sugars. Double sugars include sucrose, lactose, and maltose. These double sugars are broken down into monosaccharides, or simple sugars, during the digestion process so that they can be

absorbed by the body. The disaccharides are sucrose, maltose, and lactose. These disaccharides can be found in the following foods:

- Sucrose is cane or beet sugar found in table sugar, brown sugar, and confectioner's sugar.
- Maltose is malt sugar that is found in sprouting cereal grains and is used in breads and cereals.
- Lactose is sugar found in milk and milk products.

Polysaccharides are the most complex carbohydrates. Poly means many and saccharides means sugars. Polysaccharides include starch, dextrin, cellulose, and glycogen. Starch is the most abundant polysaccharide. Polysaccharides can be found in the following:

- Starch is found in roots, legumes, grains, and vegetables. Starches are broken down into dextrins during food processing. The word dextrin appears on some food labels. It is used as a thickening agent in certain foods.
- Cellulose is commonly referred to as fiber or roughage and is the fibrous material found in plants. It is in vegetables, fruits, and whole grain cereals.
- Glycogen is the storage form of carbohydrates. It must be converted to glucose in the body before it can be utilized by the body.

The average American consumes an estimated sixty to eighty pounds of sugar per year or approximately one-fourth pound per day. The high intake of sugar can be attributed to the amount of hidden sugars found in convenience foods and table sugar that people add to the foods they cook.

High-sugar foods or large amounts of sugar intake have been linked to health problems including the following:

- diabetes (a genetic disorder that is not caused by eating too much sugar but can be influenced by sugar intake)

- obesity
- heart disease
- tooth decay

The *Dietary Guidelines for Americans* suggest that individuals increase their intake of complex carbohydrates and decrease their intake of simple sugars or simple carbohydrates. Diets low in simple carbohydrates and high in complex carbohydrates are generally lower in fat and calories and higher in fiber, vitamins, and minerals than diets high in simple carbohydrates and low in complex carbohydrates. Figure 3.3 identifies examples of foods that contain simple and complex carbohydrates.

Simple Carbohydrates	Complex Carbohydrates
cakes	bread
candies	cereal grains
cookies	crackers
dried fruits	fresh fruits
jams and jellies	fresh vegetables
pastries	legumes
syrups	pasta
sugars	

Figure 3.3

Fiber

Fiber is found in plant tissues. Cellulose is one type of dietary fiber found in food that originates from plants. Fiber also may be called roughage. Fiber provides bulk in the diet that cannot be digested by the body. It helps promote normal waste elimination.

Fiber is generally classified into two categories: soluble and insoluble. **Soluble fiber** is dissolved in water. It can help control diabetes and lower blood cholesterol levels. Soluble fiber helps lower blood cholesterol levels by removing bile salts from the intestines as the

fiber passes through the body and is eliminated. Bile salt is a form of cholesterol. Soluble fiber is found in some fruits, beans, and oat bran.

Insoluble fiber cannot be dissolved in water. Insoluble fiber helps foods move through the digestive tract. It aids in the prevention of colon and rectal cancer, helps prevent constipation, and helps control diverticulosis. Diverticulosis is characterized by outpockets or protrusions of the intestinal wall. These pockets can become infected. Sources of insoluble fiber include fruits, vegetables, wheat bran, whole wheat, and some legumes.

Grains and Pasta

According to the United States Department of Agriculture (USDA), federal enrichment standards for pasta and grains exist for corn grits, cornmeal, wheat flour, rice, macaroni, and noodle products. These products are not required to be enriched. Only those products labeled as enriched must contain specified minimum nutrient levels. Most national brands are enriched. Federal standards specify the enrichment levels or ranges of grains and pastas for the following:

- iron
- niacin
- riboflavin (excluded from enriched rice since 1958)
- thiamin

Grains. Corn and cornmeal products are available in white, yellow, and blue varieties. Yellow corn products have higher vitamin A than the white and blue varieties. The nutrient compositions of yellow and white corn are similar with the exception of the vitamin A content.

Mesa corn flour is milled from corn that has been soaked in a lime or calcium hydroxide chemical solution. This process facilitates the removal of the outer hull of the corn grain and gives the characteristic flavor of

authentic corn tortillas. Mesa corn flour is higher in calcium than other corn products because of the lime process.

Self-rising flours and cornmeal have more calcium, phosphorus, and sodium than other flours and meals because of the addition of the chemical leavening agents and salt. The most commonly used chemical leavening agents include the following:

- monocalcium phosphate
- sodium acid pyrophosphate
- sodium aluminum phosphate
- sodium bicarbonate

Salt is added to self-rising flours and meals for seasoning purposes.

Wheat flour tortilla mix is used for making flour tortillas and other related products. The mix has calcium carbonate added. The addition of calcium carbonate makes flour tortillas higher in calcium than other wheat flour products.

Pasta. Protein-fortified pasta, macaroni, and noodle products are available on the market today. These products are available both with and without added vegetable shortening. Protein-fortified macaroni products usually contain wheat germ, dried yeast, or other ingredients that increase the protein content. A macaroni product labeled "with fortified protein" under USDA federal standards must have a protein content of at least 20 percent and a protein quality not less than 95 percent of that of casein (a protein found in milk and cheese).

Corn pasta is available primarily to meet the needs of individuals who are allergic to wheat. It is made exclusively from corn flour. Since the product contains no wheat flour it is not required to meet federal standards for macaroni or noodle products.

Breakfast Cereals

The first breakfast cereals containing added nutrients appeared on the market in the early 1940s. The nutrients added were iron, niacin, riboflavin, and thiamin. The amount of the nutrients added to the cereals restored them to whole grain levels. Cereals fortified to higher levels appeared on the market in the early 1950s. By 1969, approximately 16 percent of the breakfast cereals were fortified with nutrients. Today almost all breakfast cereals are nutrient fortified. Nutrients added to breakfast cereals today include the following:

- iron
- niacin
- riboflavin
- thiamin



The following are other nutrients that also may be added:

- vitamin B₆ (pyridoxine)
- vitamin B₁₂ (cyanocobalamin)
- vitamin A (retinol)
- vitamin C (ascorbic acid)
- vitamin D (calciferol)
- folate
- iron
- zinc
- vitamin E (alpha tocopherol)
- pantothenic acid
- copper
- calcium

In most cases, nutrients are added in quantities that provide 25 percent of the United States Recommended Daily Allowances (RDA) per serving of cereal. If a cereal has a fortification of 50 to 100 percent of the RDA, it may be labeled as a dietary supplement.

Breakfast cereals are typically eaten with milk but can be eaten dry. One-half cup of milk is generally the amount used by manufacturers to indicate nutritional information to the consumer. The addition of milk not only adds flavor and appeal, but it also adds nutrients.

Essential Questions: Carbohydrates

1. What nutrients must be present if grains and pastas are labeled enriched?
2. Describe the two classifications of fiber and their characteristics.

VITAMINS

Vitamins are organic compounds necessary in small amounts in the diet for normal growth, maintenance of health, and reproduction. Vitamins help the body convert carbohydrates and fat into energy and assist in the formation of bones and tissues. Vitamins must be provided from the diet because the body cannot produce them or cannot produce the quantity necessary. Refer to Table 3.1. for vitamins and their functions.

Vitamins are either soluble in fat or water. **Fat-soluble vitamins** can be readily stored in the body. **Water-soluble vitamins** are not stored in the body. They are easily dissolved by the water and must be replenished daily.

Fat-soluble vitamins are vitamins A, D, E, and K. The functions and sources of each of the fat-soluble vitamins are listed below:

- **Vitamin A** (retinol) is responsible for night and color vision, growth of bones and teeth, and production of healthy skin. Sources of vitamin A include dark green and dark yellow vegetables, fruits, egg yolks, whole milk, liver, butter, and fish oils.
- **Vitamin D** (calciferol) provides normal growth and development, support for normal bone mineralization, and stimulation of the active absorption of calcium and phosphorus. Sources include egg yolks, liver, fish liver oils, and fish filets.
- **Vitamin E** (alpha tocopherol) protects cells

Vitamin Letter/Number	Vitamin Name	Vitamin Function	Sources of Vitamin
Fat-soluble Vitamins			
A	Retinol	Forms and maintains healthy skin, hair, and mucous membranes; necessary for development of bones and teeth; aids vision in dim light	Yellow vegetables, dark green vegetables, liver, fish, eggs, cheese, whole milk
D	Calciferol	Allows absorption of calcium and phosphorus	Sunlight, butter, cream, fortified milk, fish liver oils
E	Alpha Tocopherol	Prevents breakdown of body tissue; protects vitamin A and essential fatty acids	Green leafy vegetables, wheat germ, beef, fish, liver, chicken, almonds, filberts
K	Phylloquinone	Promotes blood clotting; required for synthesis of prothrombin	Dark green leafy vegetables, broccoli, cabbage, lettuce, whole grain, cheese, liver
Water-soluble Vitamins			
B1	Thiamin	Helps release energy from carbohydrates; aids in the normal functioning of the nervous system	Enriched whole grain cereals, pork and other meats, fish, legumes, peas
B2	Riboflavin	Helps release energy from protein, fat, and carbohydrates	Dark green leafy vegetables, liver, milk, cheese, lean meat, legumes, eggs, whole grains, enriched cereals, ice cream
B3	Niacin	Helps release energy from protein, fat, and carbohydrates	Liver, lean meats, whole grains, nuts, legumes, cheese, enriched cereals
N/A	Folate	Helps form red blood cells and genetic material in cells	Dark green leafy vegetables, whole grains, liver, eggs
N/A	Biotin	Necessary to maintain normal body functions	Banana, grapefruit, watermelon, strawberries, liver, kidney, egg yolk
N/A	Pantothenic Acid	Helps body metabolize fats, proteins, and carbohydrates	Tomato paste, potatoes, whole grain, liverwurst, poultry
B6	Pyridoxine	Helps body use protein; aids in metabolism of fats	Egg yolk, liver, oatmeal, banana, tomato juice, beef, poultry
B12	Cyanocobalamin	Builds red blood cells and genetic material; metabolizes protein and fat; aids function of nervous system	Beef steak; beef, pork, or poultry liver; clams; eggs; milk products
C	Ascorbic Acid	Forms collagen to provide structure to bones, cartilage, muscle, and blood vessels; maintains capillaries and teeth	Fresh fruits, dark green leafy vegetables, cabbage, broccoli, beef or pork liver, clams

Table 3.1

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from oxidation. It is added to other foods to reduce or slow spoilage. Sources include vegetable oils, wheat germ, vegetables, meat, butter, egg yolks, fish liver oils, and green leafy vegetables.

- **Vitamin K** (menaquinone and phyloquinones) is necessary for blood clotting. Sources include green leafy vegetables, broccoli, peas, liver, cheese, and eggs.

Water-soluble vitamins include the B vitamins and vitamin C. The functions of each of the water-soluble vitamins and sources of each are listed below:

- **Vitamin C** (ascorbic acid) aids in the formation of hemoglobin, helps fight infection, aids in healing of wounds, aids in the formation and maintenance of collagen, and aids in the absorption of iron and calcium. Sources include citrus fruits, cantaloupe, strawberries, leafy green vegetables, broccoli, cabbage, and green peppers.
- **Thiamin** (vitamin B₁) is necessary for cell respiration, promotion of normal appetite and digestion, and maintenance of a healthy nervous system. It helps break down carbohydrates in the body and helps the body release energy from food. Sources include enriched cereals and pork. It can be found in most foods except refined sugars, oils, and fats.
- **Riboflavin** (vitamin B₂) is necessary for the body to break down carbohydrates and keep the skin, tongue, and lips in normal condition. Sources include glandular meats, cheese, milk, eggs, leafy green vegetables, enriched breads, lean meats, and legumes.
- **Niacin** (vitamin B₃) is vital to the nervous system. It helps cells use other nutrients and is beneficial for the mouth, skin, and tongue. It helps the digestive tract to function properly. Sources include liver, lean meats, whole grains, nuts, legumes, and brewer's yeast.
- **Folate** is necessary for the body to produce normal blood cells and for the biochemical

reactions of cells in the production of energy. Sources include wheat germ, wheat bran, yeast, leafy green vegetables, liver, and legumes.

- **Biotin** is essential in the breakdown of carbohydrates, lipids, and proteins in the body. Sources include liver, kidney, egg yolk, vegetables, and fruits (especially bananas, grapefruit, watermelon, and strawberries).
- **Pantothenic Acid** aids in the metabolism of energy and in the production of antibodies. Sources include all plant and animal tissues with the best sources being liverwurst, meats, poultry, egg yolk, wheat germ and rice germ, tomato paste, sweet potatoes, oatmeal, and milk.
- **Pyridoxine** (vitamin B₆) is needed to help nervous tissues function normally, to maintain the health of the skin and red blood cells, and to participate in the metabolism of proteins, carbohydrates, and fats. Sources include liver, lean meats, cereals, vegetables, and milk.
- **Cyancobalamin** (vitamin B₁₂) is necessary in the development of normal growth, normal functioning of all body cells, and protection against pernicious anemia. Pernicious anemia primarily results from the body's inability to absorb vitamin B₁₂; however, it can result from a deficiency of vitamin B₁₂ in the diet. Vitamin B₁₂ is found only in animal protein. Liver, clams, oysters, muscle meats, eggs, chicken, and milk are the best sources.

◆ **Essential Questions:** ◆
Vitamins

1. What are three functions of vitamins in the body?
2. What is the difference between water-soluble and fat-soluble vitamins?

MINERALS

Minerals are inorganic substances that become part of the bones, tissues, and body fluids. Carbohydrates, proteins, vitamins, and fats comprise approximately 96 percent of human body weight. The other 4 percent is made up of minerals.

Minerals are necessary for building bones, tissues, and other compounds as well as for regulating body processes. Minerals found in large amounts in the body are called macrominerals. Macrominerals include calcium, phosphorus, magnesium, sodium, potassium, and chloride. Minerals found in small amounts in the body are called trace elements or microminerals. Trace elements are iron, iodine, zinc, and fluorine. See Table 3.2 for mineral functions and sources.

Vitamin and Mineral Supplements

Americans spend billions of dollars on vitamin supplements. Many people use vitamin-mineral supplements because they feel their fast food and snack food diets are inadequate in providing the essential nutrients.

Vitamins work cooperatively with each other and with other nutrients to perform their functions in the body; therefore, the best way to meet the daily need for nutrients is through a balanced diet that contains a wide variety of foods.

By law, all vitamins must have the same chemical formula, whether they are natural or synthetic. Natural vitamins are made with extracts from foods. Synthetic vitamins are chemically formulated. The human body cannot distinguish one from the other, so it is not necessary to purchase the more expensive natural vitamins.

There are some people who do have vitamin and mineral deficiencies and need to take nutrient supplements. Some people who may be at risk for deficiencies include the following:

- pregnant and lactating women
- elderly persons with inadequate diets
- persons recovering from burns, injuries, or surgery
- children and adolescents with inadequate diets
- persons with chronic illnesses
- individuals with gastrointestinal malabsorption problems
- alcoholics

In most circumstances, vitamins taken in excess are of no value. Megadoses of vitamins A (retinol) and D (calciferol) can cause serious health problems. Fat-soluble vitamins such as A and D that are not used by the body are stored in fat. This makes a buildup of these vitamins more likely and more toxic. Water-soluble vitamins not used by the body are excreted in the urine, making it less likely for toxic levels to occur.

◆ **Essential Questions:** ◆ **Minerals**

1. How are macro-minerals and micro-minerals different?
2. What functions do vitamins and minerals have in the body?
3. When are vitamin and mineral supplements necessary?

FAT

The term *lipids* is often used interchangeably with the term fat. Lipids in the simplest forms are called fatty acids. Fats or lipids are important sources of energy needed and used

Macrominerals		
Macrominerals	Functions	Sources
Calcium	• Needed for bone rigidity, blood clotting, muscle contraction, normal nerve functions • Just because an individual eats food containing calcium does not mean that the body absorbs the calcium. Factors that increase calcium absorption include the following: - an overall balanced diet - intake of vitamins D and C - intake of certain amino acids • Factors that decrease calcium absorption include the following: - a vitamin D deficiency - fat malabsorption - eating large amounts of fiber - lack of exercise - stress - lactose deficiency or lactose intolerance	Milk and milk products, soft-boned fish, calcium-fortified orange juice, leafy green vegetables, and broccoli
Phosphorus	• Helps build strong bones and teeth and is a significant factor in all phases of calcium metabolism	Meat, poultry, liver, fish, eggs, milk, other dairy products, raw oranges, cherries, peaches, rice, potatoes, and wheat flour. Eating foods high in calcium will provide adequate phosphorus
Magnesium	• Helps regulate - body temperature - muscle contractions - the nervous system • Helps cells utilize - carbohydrates - fats - proteins	Green leafy vegetables; nuts including Brazil almonds and cashews; muscle meats; salmon; cheddar cheese; beef liver; milk; and eggs. Vitamin D increases the body's absorption of magnesium.
Sodium, chloride, potassium	• These three work together to: - regulate the flow of fluids in the body - help regulate the nervous system - help regulate the muscle functions, including heart - help regulate nutrient absorption in the cells	Sources for sodium and chloride are found in table salt, while potassium can be found in meats, milk, bananas, leafy green vegetables, and citrus fruits.

⇒ Table 3.2

Microminerals		
Microminerals	Functions	Sources
Iron	Found primarily in the blood, where it combines protein to form hemoglobin (oxygen-carrying protein in the blood)	Liver and other organ meats, egg yolks, dried legumes, shellfish, leafy green vegetables, and enriched breads. It is estimated that only 10 to 15 percent of the iron in foods is actually absorbed.
Zinc	Zinc is needed for the lungs to release oxygen	Oysters, herring, egg yolks, and organ meats
Copper	Copper is necessary in the formation of hemoglobin	Liver, bran flakes, and cocoa powder
Manganese	The role of manganese is not well-understood	Nuts, rice, whole grains, beans, and leafy green vegetables
Selenium	selenium works in conjunction with vitamin E to protect cells from destruction. It has been suggested that selenium may have a role in the prevention of cancer.	Fish, organ meats, shellfish, and eggs. Grains and other plants, grown in selenium-rich soil are also good sources
Chromium	chromium maintains the normal glucose uptake into cells and helps insulin bind to cells	Vegetable oils, egg yolks, whole grains, and meats. Fruits, vegetables, high processed foods, and drinking water are generally poor sources of chromium
Iodine	Iodine is needed for the thyroid gland to produce thyroxine, which is essential for the oxidation rates of cells	Iodized salt, ocean fish, seaweed, and milk
Fluoride	Fluoride is needed to prevent tooth decay	Fluoridated drinking water, seafood, tea, fluoridated toothpaste, and fruits and vegetables grown in areas where natural fluoride level in the water is high

⇒ Table 3.2, Cont'd.

by the body. The functions of fat in the body include the following:

- provide energy
- transport and absorb fat-soluble vitamins
- cushion vital organs in the body
- comprise part of the structure of body cells
- supply essential fatty acids
- add flavor to foods
- satisfy appetites by delaying hunger
- insulate the body
- serve as protection for nerves and blood vessels

Foods that contribute fat to the diet include butter, margarine, lard, chicken, meat, salad dressing, vegetable oil, milk and milk products, fish, nuts, olives, avocados, and whole grain cereals. Fats are also found in many baked goods, desserts, and snacks.

The total amount of fat in the diet should be kept to a moderate level. An individual's diet should consist of no more than 30 percent fat. Many sources recommend that of this 30 percent, 10 percent should come from saturated fats, 10 percent from unsaturated fats, and 10 percent from polyunsaturated fats. Polyunsaturated fats found in plant food products are the best types of fat for human consumption and can substitute for saturated fats.

◆ **Essential Questions:** ◆
Fat

1. How much fat is recommended for a regular diet?
2. What are the functions of dietary fat?

WATER

Water is necessary in the body for many reasons. It acts as a solvent for nutrients and hormones. It acts as a transport mechanism for nutrients to cells and for ridding the body

of waste products. It serves as a lubricant in joints; facilitates food passage; and regulates body temperature through conduction of heat, perspiration, and excretion.

The body typically uses two to two and one-half liters of water per day. It is recommended that the daily diet include at least eight 8 ounce glasses of water per day.

Sources of water include beverages, soups, water, and milk. Other sources of water include the following:

- vegetables 87 percent
- fresh fruits 86 percent
- eggs 74 percent
- beef 60 percent
- bread 36 percent



◆ **Essential Questions:** ◆
Water

1. How is water beneficial to daily body functions?
2. What are the functions of lipids in the body?

NUTRIFICATION

It is possible to improve the nutritional value of foods through the process of nutrification. **Nutrification** refers to the addition of nutrients to foods. When nutrients are added to foods, the concentration of those nutrients increases.

The three basic types of nutrification are enrichment, fortification, and restoration. The process of nutrification began in the 1930s after the discovery of most of the vitamins and their functions. Examples of foods with

added nutrients include dry cereal, breakfast bars, enriched flour, margarine, pasteurized milk, nonfat dry milk, infant formula, and table salt.

Enrichment refers to the addition of nutrients that are naturally present in the product. The enrichment increases the amount of the nutrients present in the food. By increasing the amount of the nutrients in the product, the consumption of the nutrient will increase accordingly. Examples of enriched food products include breads, cereals, and some flours.

Enrichment and restoration are often used interchangeably. Restoration refers to the process of replacing nutrients in a food product that were lost during processing. Riboflavin and thiamin were first restored to white bread in the 1930s. By 1941, legislation was passed requiring the restoration of riboflavin and thiamin to white flour and bread. The fortification of niacin and iron also was required.

Fortification refers to the addition of nutrients that may or may not be found naturally in the product. As with enrichment, fortification increases the consumption of various nutrients. Fortification is intended to correct nutritional deficiencies in special segments of the population.

The nutrification of various foods has changed and improved in recent years. Protein can be added to foods with synthetic amino acids or by adding small quantities of foods rich in protein into foods that are not protein rich. For example, milk powder, soy protein concentrate, and yeast preparations can be added to other foods to increase the protein content. There are many other ways that the nutrient content of foods can be increased.

The nutrification of foods became increasingly important after nutritional labeling laws were passed in the early 1970s. Labeling laws

passed in 1990 also will have had a great impact on nutrification. According to the American Medical Association and the National Academy of Sciences National Research Council, supplements (the process of nutrifying foods or providing additional nutrients in nonfood forms) are considered approved if the following occur:

- low intake of the nutrient or nutrients in a significant proportion of the population exists
- the added nutrient will be stable under proper storage conditions
- the added nutrient will not cause an imbalance in the other nutrients present in the food
- the body can absorb and utilize the added nutrient
- the addition of the nutrient will make a significant contribution to the diet of the population needing it
- the supplement will not increase the intake level of the nutrient to that of toxicity

Nutrification has a number of advantages and disadvantages. Some of the advantages include the following:

- Nutrification does not change the taste, odor, or appearance of the food product.
- Fortification is an effective way to improve nutrient content.
- All segments of the population can be reached.
- Nutrification is relatively inexpensive.

Disadvantages of nutrification include the following:

- Only those that eat the nutrified foods benefit from nutrification.
- Nutrification adds to the cost of the product.
- Some people avoid foods with any type of additive—good or bad.
- A certain amount of waste occurs with nutrification because some products may be nutrified to incorporate 100 percent of the Recommended Daily Allowance (RDA) of a nutrient. There are no regulations. The Food and Drug Administration (FDA)

classifies a food as a drug if the amount of a particular nutrient exceeds 150 percent of the RDA.

◆ **Essential Questions:** ◆
Nutrification

1. What makes foods nutrient dense?
2. How are nutrients added to food?
3. How might labeling laws affect nutrification?

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Chapter Highlights

- ☆ Nutrition is the process of nourishment. It involves the conversion of substances in food into the nutrients the body needs for daily functioning and maintaining health and wellness.
- ☆ The study of nutrition is a science that involves the relationship of growth, development, and overall health to the intake of nutrients.
- ☆ No one food contains all of the nutrients necessary for the body to function effectively; therefore, a balanced diet that incorporates appropriate amounts of the six nutrients, as well as recommended servings from the basic food groups, is necessary.
- ☆ Sources of complete proteins include the following meat, milk, cheese, eggs, poultry, and fish.
- ☆ The six essential nutrients are protein, carbohydrates, vitamins, minerals, fats, and water.
- ☆ Protein is the main component of every cell in the human body. The body uses protein for growth and repair of tissues, regulating body functions, transporting other nutrients and oxygen, and supplying energy.
- ☆ Carbohydrates come in three forms: sugars (simple carbohydrates), starches (complex carbohydrates), and cellulose (complex carbohydrates).
- ☆ Carbohydrates are nutrients that supply energy for body functions.
- ☆ Vitamins are organic compounds necessary for normal growth, maintenance of health, and reproduction.
- ☆ Minerals are necessary for building bones, tissues, and other compounds.
- ☆ Fats or lipids are important sources of energy needed by the body.
- ☆ Water is necessary in the body as a solvent for nutrients and hormones. Water also transports nutrients to the cells and rids the body of waste products. It lubricates the joints, facilitates food passage, and regulates body temperature through conduction of heat, perspiration, and excretion.

Chapter 4

Digestion and Metabolism



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 4A Describe the processes of digestion and metabolism.
- 4B Describe basal and activity metabolism and factors that affect each.
- 4C Apply knowledge of digestion and metabolism when making decisions related to food intake and physical fitness.



Chapter Vocabulary

basal metabolism

basal metabolic
rate (BMR)

dietary fiber

digestion

enzymes

gastrointestinal tract

metabolism

peristalsis

satiety

THE PROCESS OF DIGESTION

Through the digestive process, nutrients in food undergo changes that enable the body to absorb and use them. **Digestion** is the process the body uses to transform food into a form it can use. Digestion has two major actions: chemical and mechanical. Mechanical digestion happens as food is crushed and churned. In chemical digestion, food is combined with powerful acids and enzymes which cause chemical reactions in various areas of the body. These chemical reactions help to

break down nutrients so they can be absorbed. **Enzymes** are the "workers" which do the job of converting food into compounds the body can use for energy, metabolism, and other functions. While traveling through the digestive tract, food makes stops along the way, and specific enzymes help break down food into nutrients that provide energy and build new tissue. The whole digestion process passes through a muscular tube leading from the mouth to the anus. This tube is called the **gastrointestinal (GI) tract**. The GI tract can be as long as thirty feet and is divided into sections that perform specific functions. There are six key parts in the digestion pro-

cess: the mouth, esophagus, stomach, small intestine, liver, and large intestine. See Figure 4.1.

Mouth

Mechanical digestion begins in the mouth where food is crushed by the teeth (chewing) into smaller pieces. Chemical digestion begins when an enzyme, *ptyalin* (found in saliva), helps to break down complex carbohydrates (starches) into simple carbohydrates (sugars). For this reason, a starchy food, such as a saltine cracker, will taste sweet as the starch is broken down in the mouth. The physical breakdown of food in the mouth by chewing and grinding helps the food to move to the next stop, the esophagus.

Esophagus

After food is swallowed, the esophagus moves it to the stomach. The esophagus is approximately twelve inches long. Muscles of the esophagus contract and relax in a wave-like movement called *peristalsis*. Peristaltic waves move food along the entire digestive tract. The esophagus is the passageway for food to move from the mouth to the stomach. Being sad, depressed, or afraid can affect peristalsis and sometimes decrease gastric action. Being angry or aggressive can increase movement. This muscular movement forces the food down the pathway to the stomach.

Stomach

The stomach is the largest area on the digestive path. The stomach can hold approximately two to three pints of food. Digestion in the stomach is mainly the breaking down of proteins. Digestion of protein foods occurs in the stomach where two enzymes, *rennin* and *pepsin*, start to work to breakdown the proteins into smaller compounds. Food is churned through peristaltic waves and broken down by gastric juices. As the stomach churns food, the gastric juices work to break down

protein. Walls of the stomach manufacture gastric juices and churn the food until it turns into a thick liquid called *chyme*. Liquids are digested quickly. In contrast, solids may take approximately four hours to digest. Foods that are chewed well leave the stomach more easily than large pieces. Fats stay in the stomach the longest and provide *satiety* or satisfaction and fullness. Proteins usually take three to five hours, while carbohydrates take the shortest amount of time to digest, only one to two hours. As a result, an individual may feel hungry sooner after a meal high in carbohydrates than a meal high in fats and proteins.

Small Intestine

After leaving the stomach, food enters the upper part of the small intestine called the duodenum. Food is mixed and combined with digestive chemicals: bile from the liver (bile works on digesting and absorbing fats), pancreatic juice from the pancreas (pancreatic juices contain enzymes that work to break down carbohydrates, fats and proteins), intestinal fluids, and enzymes. Here, food is broken down into nutrients the body can use.

- Carbohydrates change to the simple sugar glucose.
- Fats change to fatty acids which provide energy and glycerol.
- Proteins change to amino acids.
- Vitamins and minerals remain basically unchanged.

The small intestine is lined with hairlike projections called villi. Villi filter and absorb the materials from the small intestine. Villi then help move the waste products to the large intestine. Figure 4.2 shows villi lining the small intestine increasing the surface area through which nutrients can be absorbed into capillaries and lacteals.

The Digestive System

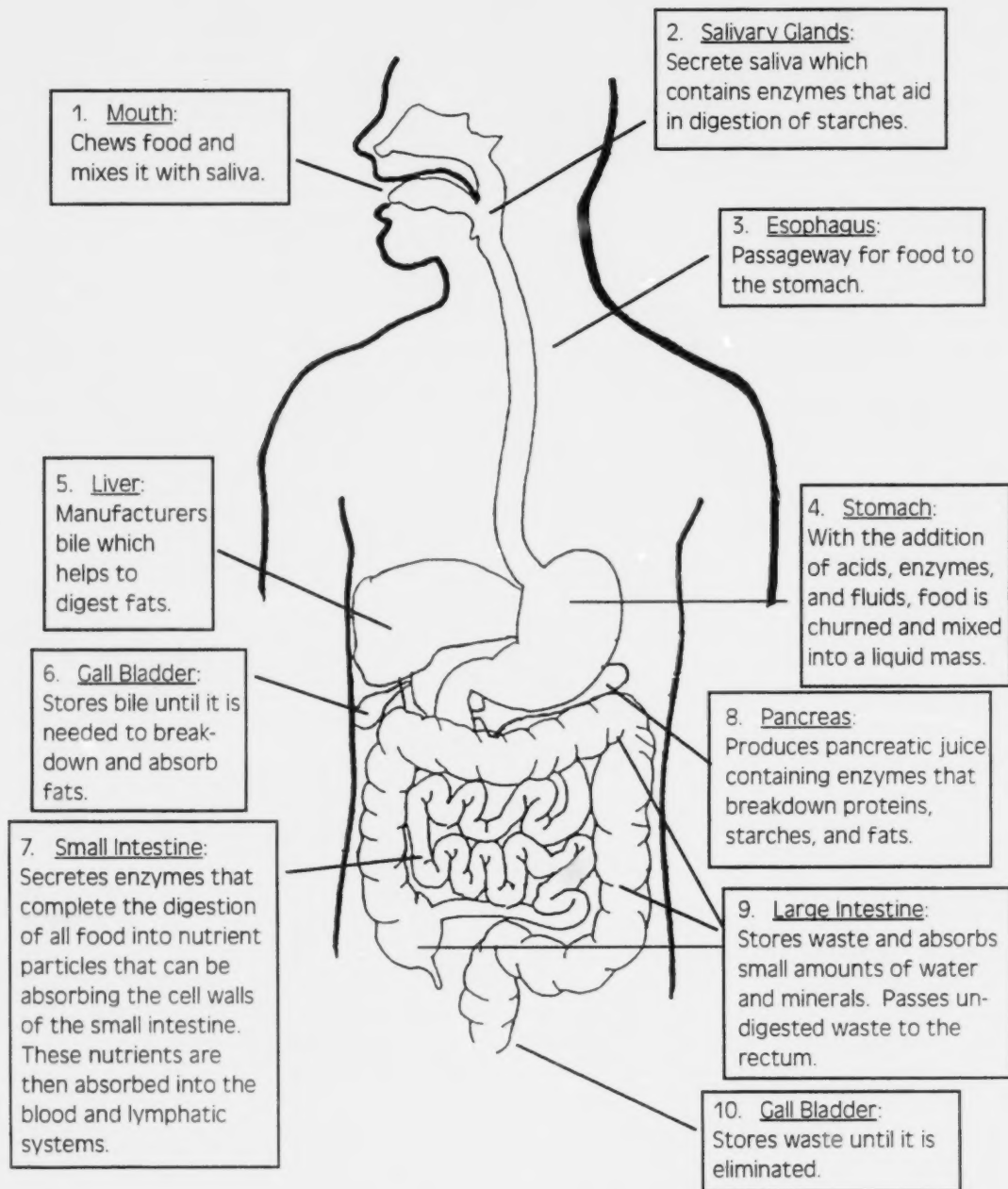
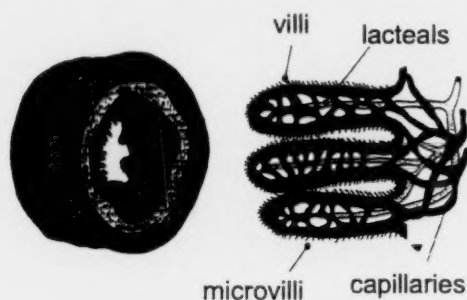


Figure 4.1



Source: Reprinted with permission. Nutrition and Fitness by Dorothy West and published by Goodheart-Wilcox Co.

Figure 4.2

Liver

The liver manufactures, changes, and stores nutrients and chemicals needed by the body. The liver turns glucose, a simple sugar used for energy, into glycogen for storage. The liver converts glycogen to glucose and sends it to the bloodstream when the body needs it. The liver recycles iron and worn-out blood cells from the blood.

Large Intestine

Healthy bacteria needed for digestion is found in the large intestine. Here, water is absorbed and sent to the kidneys. Fiber from food absorbs some of that water and helps to soften waste so it is eliminated more easily. Waste products (bacteria, excess nutrients, and what is left of the food) are excreted through the rectum. The large intestine acts as a "holding place". It is a storage area waiting for the body to excrete these waste materials in the feces. Approximately 10 percent of the food eaten ends up as waste.

Essential Questions The Process of Digestion

1. What is the process called by which food is used by the body?
2. What are the six key parts that process food along the path of digestion?
3. What are the functions of each of these parts?
4. How might emotions, such as worry or anger, lead to digestive problems?

METABOLISM

Once digestion is complete, absorption of nutrients for the body's use must take place. Nutrients must be taken where they can be used or stored until needed. Nutrients are transported with oxygen to the cells of the body through the circulatory system. Nutrients provide energy and other special tasks for the cells. Once nutrients are inside the cells, they are used. This process where nutrients are burned for heat and energy or used to build new tissue is called **metabolism**.

Metabolism involves chemical changes that take place in cells after nutrients have been absorbed. These metabolic reactions enable nutrients to be used for growth, heat, or energy. Many of the chemical reactions in the body rely on water. Water is a vital part of the body's metabolism.

The body needs energy to carry out three basic functions: basal metabolism, physical activity, and thermic effect of food. Figure 4.3 gives examples of each.

Energy Use by the Body

Physical Activity:

- exercising
- running
- working
- reading

Basal Metabolism

- maintaining heart beat
- respiration
- body temperature
- sleeping

Thermic Effect of Food:

- digestion
- absorption
- metabolism
- storage of nutrients

Figure 4.3

Basal Metabolism

Energy is the power to do work. The body needs energy not only to participate in physical activity, but also to perform automatic body functions. When the body is resting or sleeping it is using energy. The amount of energy needed for the body at physical, digestive, and emotional rest is called **basal metabolism**. The body requires a certain amount of energy just to stay alive and carry out vital functions. Basal metabolism is sometimes referred to as **BMR**, or **basal metabolic rate**. There are many factors that affect your BMR. Figure 4.4 illustrates these factors.

- **Supply of Nutrients** - An inadequate supply of nutrients due to illness, fasting, or malnutrition slows down the BMR. As a survival technique, the body will burn calories more slowly to help sustain life.
- **Gender** - Males have higher BMR than females due to a higher percentage of lean

Factors that affect BMR

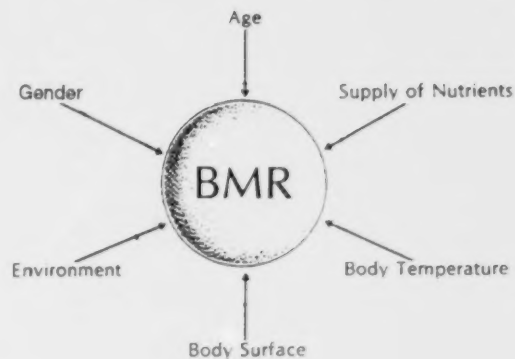


Figure 4.4

tissue. Lean tissue has a higher metabolic rate than fat tissue.

- **Environment** - Persons living in areas where they have prolonged exposure to cold temperatures burn more calories to stay warm and have a higher BMR.
- **Body Temperature** - Increased body temperature causes the BMR to increase. A person with a fever will have a higher BMR than normal.
- **Body Surface** - Due to heat loss through the body's surface area, a short person of the same weight as a tall person will have a lower BMR.
- **Age** - BMR decreases with age in adulthood. It is estimated that BMR decreases by two percent per decade in adulthood.

The factors above vary in the effects they have on an individual's basal metabolic rate; however, a simple mathematical formula can be used to approximate the BMR. Use the following formula in calculating BMR for males and females. See figure 4.5.

- BMR factors for males = 1Kcal per kg of body weight per hour
- BMR factors for females = 0.9 kcal per kg of body weight per hour

Formula to Figure Approximate BMR

1. First, body weight must be converted from pounds (lbs.) to kilograms (kg).

$$\frac{\text{weight in pounds}}{2.2} = \text{weight in kilograms (kg)}$$
2. Multiply the body weight in kg by the BMR factor to find the kcal used per hour for basal metabolism.

$$\text{Weight in kg} \times \text{BMR factor (1.0 for males; 0.9 for females)} = \text{kcal used per hour}$$
3. Multiply the kcal used per hour times 24 to calculate the kcal used per day for basal metabolism.

$$\text{kcal used per hour} \times 24 = \text{total kcal needed per day for basal metabolism}$$

This figure is the BMR.
4. Figure the BMR for a 165 lb. male.
 - 1) $\frac{165 \text{ lb.}}{2.2} = 75 \text{ kg.}$
 - 2) $75 \text{ kg} \times 1.0 = 75 \text{ kcal used per hour}$
 - 3) $75 \text{ kcal} \times 24 \text{ hrs.} = 1800 \text{ kcal}$
 - 4) $\text{MR} = 1800 \text{ kcal per day}$

⇒ Figure 4.5

◆ Essential Questions: ◆ Metabolism

1. What are the factors that affect a person's BMR? Explain.
2. How are nutrients burned for heat and energy for the body's use?
3. How does the body use energy when it is at rest?

A better understanding of digestion and metabolism helps individuals realize the importance of providing foods for the body that are nutrient-rich. It is important to make wise food choices and to recognize the importance in achieving and maintaining good health. Along with choosing foods rich in nutrients, individuals should select foods that contain fiber. Fiber is important because it aids in the digestive process.

DIETARY FIBER

Dietary fiber is found in foods made up of plant materials that do not breakdown in the digestive system. Fiber in foods is found in plant sources such as grain products, beans, peas, fruits, and vegetables. Animal sources do not have fiber. Most plants contain two kinds of fiber. Soluble fiber dissolves in water and insoluble fiber cannot be dissolved in water.

Insoluble fiber is found in vegetable and fruit skins and whole-wheat products and lowers the risk of colon cancer. This type of fiber helps aid in bowel movements and helps prevent constipation. Insoluble fiber works in the digestive system to absorb water and help move food through the large intestine.

Soluble fiber dissolves in water. Soluble fiber sources are fruits and vegetables, oat products, peas, beans, and lentils. Benefits of this type of fiber are linked to lowering blood cholesterol levels.

The National Cancer Institute recommends twenty to thirty grams of dietary fiber a day. Fiber has many functions in the body. Some of these functions help prevent health problems. For Example:

- Fiber keeps contents of the intestines moving and prevents constipation.
- Fiber helps reduce the risk of colon cancer by allowing food to pass quickly through the digestive tract. This limits susceptibility to agents in foods that might cause cancer.
- Fiber stimulates muscles of the digestive track. Well-toned digestive track muscles aid in prevention of diverticulosis and hemorrhoids.
- Fiber absorbs water and gives a feeling of fullness. This helps people feel full longer and this contributes to healthy eating and weight control. Figure 4.6 lists the top ten high fiber foods. Making selections from this list will aid in dietary fiber intake.

DIGESTIVE DISORDERS

Occasionally people will experience digestive disorders. There are many medications on the market to treat digestive problems, but most of these medications are unnecessary if the focus is on eating a nutritious diet. Including a variety of high-fiber vegetables, fruits, and whole-grain products helps avoid digestive disorders. The digestive system is complex, and serious illnesses can develop if it is not functioning correctly. Listed below are some of the problems that sometimes can occur:

- *Diarrhea* - a frequent expulsion of watery feces. Drinking water will help restore lost fluid for the body. Prolonged diarrhea symptoms indicate a need for medical attention.
- *Constipation* - occurs when chyme (a mixture of gastric juices and chewed food) moves too slowly through the large intestine. This causes the feces to become hard and difficult to eliminate. Increasing

physical activity, drinking water, as well as improving eating habits can help.

- *Indigestion* - symptoms include gas, stomach cramps, and nausea.
- *Heartburn* - burning pain in the middle of the chest but has nothing to do with the heart. Heartburn is also known as reflux. It is caused by stomach acid flowing back into the esophagus.
- *Ulcer* - an open sore in the lining of the small intestine or stomach. The symptom of the ulcerated area is a burning pain. Ulcer patients are encouraged to eat a nutritious diet and decrease stress levels.
- *Gallstones* - small crystals that form from bile in the gallbladder. Gallstones block the duct between the gallbladder and the small intestine and cause severe pain.
- *Diverticulosis* - a condition in which abnormal sacks or pouches form in the intestinal wall and become inflamed. It is often caused by a diet too low in fiber.

Long-term illnesses can have serious effects on digestion and the absorption of nutrients. Such illnesses like those mentioned above often require medical supervision and treatment.

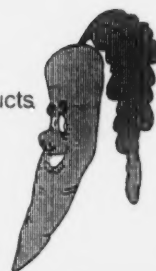
◆ Essential Questions: ◆ Dietary Fibers/Digestive Disorders

1. What is the main job of the large intestine?
2. How can digestive disorders affect overall health of an individual?
3. Why is eating fiber-rich foods important in the digestion process?

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The Top Ten Fiber Foods

1. Broccoli
2. Bran cereals
3. Raisins and prunes
4. Almonds
5. Brussels sprouts
6. Raspberries, blackberries, and strawberries
7. Green peas
8. Whole-wheat and other whole-grain cereal products
9. Carrots
10. Turnip greens



⇒ *Figure 4.6*



Chapter Highlights

- ☆ Digestion is the process the body uses to transform food into a form it can use.
- ☆ There are six key parts in the digestive process: the mouth, esophagus, stomach, small intestine, liver, and large intestine.
- ☆ The process where nutrients are burned for heat and energy or used to build new tissue is called metabolism.
- ☆ Your energy needs are based on your basal metabolic requirements and your activity level.
- ☆ Basal metabolism refers to the amount of energy the human body needs just to stay alive and carry on vital processes.
- ☆ Dietary fiber is found in foods made up of plant materials that do not breakdown in the digestive system. Fiber is important because it aids in the digestion process of your body.
- ☆ Most plants contain two kinds of fiber. Soluble fiber dissolves in water and insoluble fiber cannot be dissolved in water.
- ☆ Insoluble fiber is found in vegetable and fruit skins and whole-wheat products and lowers the risk of colon cancer. Insoluble fiber works in the digestive system to absorb water and help move food through the large intestine.
- ☆ Soluble fiber dissolves in water. Soluble fiber sources are fruits and vegetables, oat products, peas, beans, and lentils. Benefits of this type of fiber are linked to lowering blood cholesterol levels.
- ☆ The National Cancer Institute recommends twenty to thirty grams of dietary fiber a day.

Chapter 5

Planning Healthy Diets



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 5A Plan diets appropriate to life cycle, activity level, culture, gender, and food budget.
- 5D Devise strategies to deal with special dietary considerations including needs of women during pregnancy and lactation.
- 5E Utilize various guidelines and technology in evaluating diets.



Chapter Vocabulary

budget	growth spurts
Daily Values	lactating
diet	Meals on Wheels
Dietary Guidelines for Americans	nutrient density
Dietary Reference Intakes	nutrition facts
Food Guide Pyramid	nutrition standards
	Recommended Dietary Allowances
	vegetarian diet

NUTRITION STANDARDS

Americans are fortunate to have **nutrition standards** based on scientific research to help guide them in making wise food choices that promote good health and reduce the risk of disease. Learning to use these standards as a basis for making nutritious food choices is an important step in developing good eating habits and a lifelong commitment to good

nutrition. Using nutrition standards, such as the *Recommended Dietary Allowances* and *Dietary Reference Intakes*, along with the *Food Guide Pyramid* and *Dietary Guidelines for Americans* helps individuals have the knowledge and skills needed for making wise food choices.

Recommended Dietary Allowances

The Food and Nutrition Board of the National Academy of Sciences was established in 1940 to study issues of national importance pertaining to the safety and adequacy of the nations' food supply, to establish principles and guidelines for adequate nutrition, and to render authoritative judgment on the relationships among food intake, nutrition, and health. One of the Food and Nutrition Board's first actions was to publish the first edition of the ***Recommended Dietary Allowances (RDA)***, which is based on scientific data of the nutrients needed to ensure adequate nutrition for people in the United States. The RDA's are a set of nutrient standards established for the maintenance of good nutrition. These standards are based on the energy and nutrients needed for good health and that reduce the risk of chronic disease.

Dietary Reference Intakes

Since the establishment of the RDAs, scientific knowledge related to nutrition and health has increased dramatically. This new knowledge includes findings that show the interrelationships of diet, nutrition, and many chronic diseases. Therefore, the Food and Nutrition Board, in partnership with Health Canada, has created ***Dietary Reference Intakes (DRI)*** to refer to three types of reference values used to determine nutritional adequacy. The RDA is one of these three reference values. The other two are known as Estimated Average Requirement (EAR) and Tolerable Upper Intake Level (UL). This new information assists dietitians, physicians, nutritionists, and other professionals in designing dietary plans that work in concert with other health practices in treatment and prevention of chronic disease.

TOOLS FOR PLANNING A NUTRITIONALLY-BALANCED DIET

Dietary Guidelines for Americans

The United States Department of Agriculture and Health and Human Services have developed seven guidelines with health-related outcomes in mind. They answer the question, *What should I eat to remain healthy?* Regardless of lifestyle and culture, the guidelines are general and easy for all Americans to follow. Research has shown that people in the United States are eating a diet too high in fats, cholesterol, and sugar, which increases the chance of developing life threatening diseases such as heart disease, stroke, cancer, and liver disease. See Figure 5.1 for the ***Dietary Guidelines for Americans***.

Food Guide Pyramid

In 1992, the United States Departments of Agriculture and Health and Human Services developed the ***Food Guide Pyramid***, a guide to daily food choices. The Food Guide Pyramid was meant to replace the *Basic Four* developed in the 1950s. Both emphasized variety in food choices, but the pyramid is the new personal guide for making healthful choices. It is a practical, visual, and flexible guide to help individuals select foods for a healthy diet. The Food Guide Pyramid was developed to be used by young and old, male and female. Foods are grouped into five main categories with a range of daily servings individuals should eat from each group. Following the Food Guide Pyramid (Figure 5.2) can help reduce the risks of many diseases.

Daily Values on Food Labels

Nutrition Facts on food labels can serve as another valuable tool in planning a healthy diet. The amounts of nutrients in a serving of a food are expressed as percentage of Daily Values. ***Daily values*** are recommended nutrient intakes based on daily calorie needs.

Dietary Guidelines for Americans

Aim for Fitness. . .

- ▲ Aim for a healthy weight.
- ▲ Be physically active each day.



Build a Healthy Base. . .

- Let the Pyramid guide your food choices.
- Choose a variety of grains daily, especially whole grains.
- Choose a variety of fruits and vegetables daily.
- Keep food safe to eat.

Choose Sensibly. . .

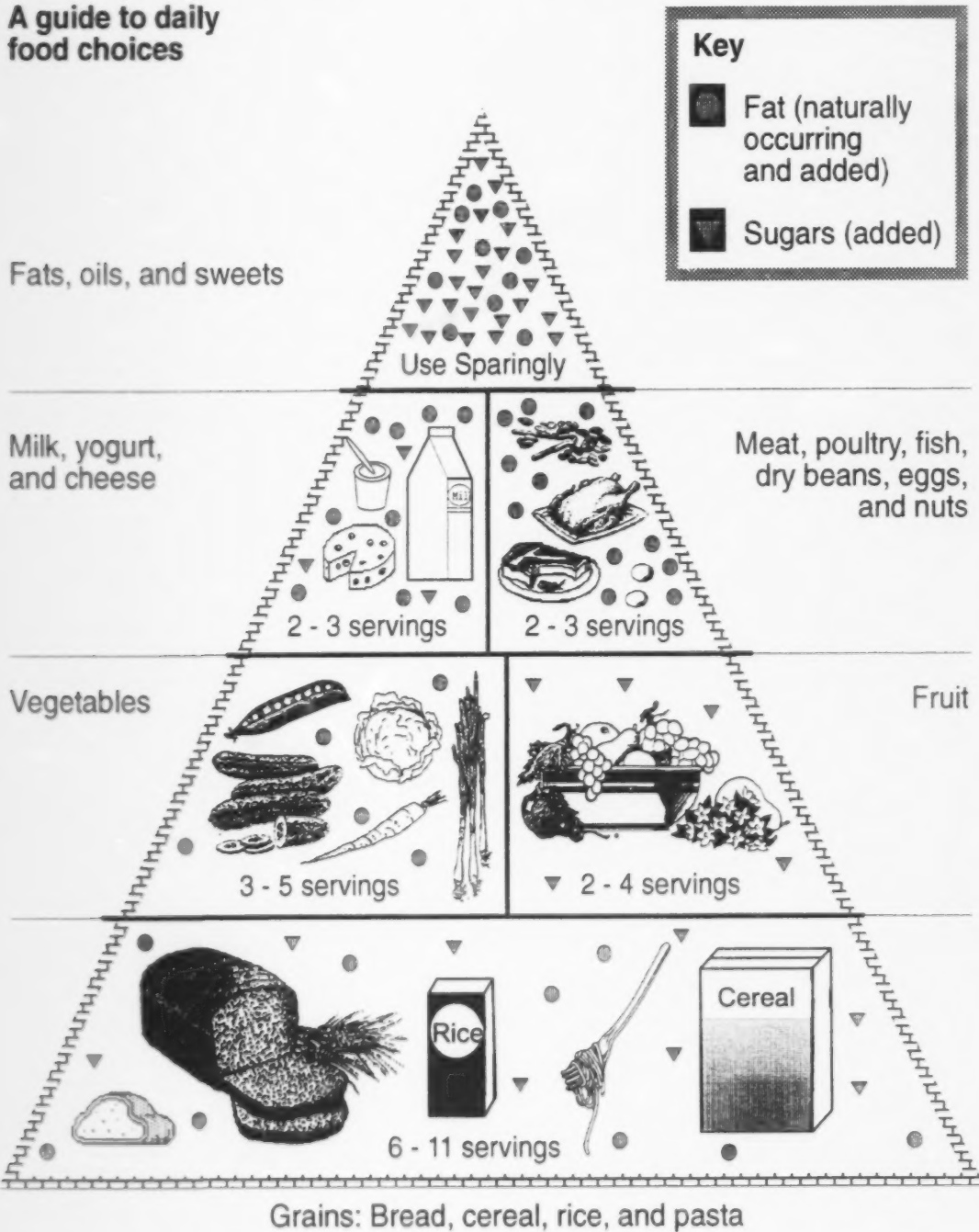
- Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.
- Choose beverages and foods to moderate your intake of sugars.
- Choose and prepare foods with less salt.

Source: "Dietary Guidelines for Americans," 2000, 5th edition. USDA

⇒ Figure 5.1

Food Guide Pyramid

A guide to daily food choices



Adapted from: "The Food Guide Pyramid," Home and Garden Bulletin No. 252, United States Department of Agriculture Human Nutrition Information Service.

⇒ Figure 5.2

Using this tool, an individual might compare protein content in two different foods and determine the most nutritious choice. See Figure 5.3 for an example of the "Nutrition Facts" from a food label.

Nutrition Facts			
Serving Size 1/2 cup (114g)			
Servings Per Container 4			
Amount Per Serving			
Calories 90 Calories from Fat 30			
% Daily value*			
Total Fat	3g		5%
Saturated Fat			0%
Cholesterol	0mg		0%
Sodium	300mg		13%
Total Carbohydrate	13g		4%
Dietary Fiber	3g		12%
Sugars	3g		
Protein	3g		
Vitamin A 80% • Vitamin C 60%			
Calcium 4% • Iron 4%			
* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
Calories per gram:			
Fat 9 • Carbohydrate 4 • Protein 4			

⇒ Figure 5.3

Dietary Analysis

Being aware of the foods eaten and periodically analyzing nutrient intake can also aid in healthful eating. A number of computer software programs can quickly analyze diets. The program can tell the nutrient and calorie content of the foods recorded. These programs compare RDAs and DRIs to daily nutrient intake. This comparison indicates which nutrients are lacking.

◆ Essential Questions: ◆ Tools for Planning a Nutritional Balanced Diet

1. Why were the Dietary Guidelines for Americans developed?
2. What dietary tools can individuals use to reduce their risks of diet-related diseases?
3. How can the Food Guide Pyramid be used for planning a healthy diet?

NUTRITIONAL NEEDS ACROSS THE LIFE SPAN

Nutritional needs change during the various stages of the life span. The varying stages of growth that take place from infancy through adolescence make different demands on the body's nutritional health. Likewise, the stages of adulthood have different nutritional requirements. **Diet** is a term which means all the food and drink one person consumes. Each stage of a person's life span affects his/her diet choices. Poor nutrition at any time during the life span can cause health problems and/or shorten life expectancy.

Due to increased health awareness and advances in medical science, Americans are living longer than ever before. It is anticipated that by the year 2050, the percentage of

the population age eighty-five years and older will increase to more than 5 percent of the total U.S. population. These predictions increase the need for consumers to understand the nutritional needs during the various stages of life. Refer to Table 5.1 for special nutrition requirements across the life span.

Pregnancy and Lactation

Pregnancy is a very important stage in the life cycle. Many young women do not realize that their nutritional health during the years before they become pregnant has an effect on their future pregnancy and the development of the fetus. It is also important to realize that decisions the expectant mother makes about nutrition affects her baby's health and future.

An increased need for protein, folate, vitamin B₁₂ (cyanocobalamin), calcium, phosphorus, magnesium, and iron is necessary to supply enough nutrients for fetal growth and development as well as for the mother's nutritional health. Even though the nutrient needs are much greater, the pregnant woman's energy needs only increase about 15 percent. This means the expectant mother should choose foods of high nutrient density rather than just empty calories. **Nutrient density** refers to foods that are excellent sources of essential nutrients but are low in calories. Teenage pregnancies often are characterized by nutrient deficiencies in the mother. Teenage mothers are still growing and need high levels of nutrients for their own development, as well for the growing fetus. Low birth weight and some learning disabilities can be linked to poor pre-natal nutrition. All pregnant women should avoid drugs, smoking, and drinking alcoholic beverages because of the potential risks in the physical and mental development of the fetus. Choosing nutrient-rich foods is very important before, during, and after pregnancy. Using the Food Guide Pyramid aids expectant mothers in eating a well-balanced diet rich in the essential nutrients. The physician may recommend a

pre-natal vitamin and mineral supplement to cover the increased nutrient needs.

The practice of good nutrition during pregnancy is critical. During the first trimester, or approximately thirteen weeks, inadequate nutrition or drug use can result in birth defects. By the end of the first trimester, the heart is completely formed and is beating and most of the organs are formed. During the second trimester, the fetus continues to grow and develop, and the bones become noticeably visible throughout the baby's body. The third trimester is also a very critical time for development. Deficiencies in certain nutrients can cause damage to the eyes, brain, and genitals as development is completed prior to birth.

A pregnant woman's physician will probably recommend a well-balanced diet of nutrient dense foods. Because weight gain during pregnancy must be carefully monitored, it is essential that the expectant mother learn which foods provide the best nutrition without the added calories of excessive fat and sugar. Specifically, foods such as milk, lean meat, legumes, eggs, vitamin C-rich foods, dark green vegetables, and whole-grain breads and cereals are recommended. Table 5.2 outlines a daily food guide for the expectant mother.

The nutritional need for iron and folate increases substantially during pregnancy. Many physicians may even recommend supplements of iron and folate because it may be difficult for many pregnant women to get the amount that is needed in their diet. Iron is needed during pregnancy for hemoglobin synthesis. Hemoglobin is the protein in red blood cells that carries oxygen to the cells and carbon dioxide away from the cells. The daily need for iron increases from 15 milligrams for a non-pregnant female to 30 milligrams for a pregnant female. The need for folate increases from 180 micrograms to 400 micrograms during pregnancy. Folate is needed

Special Nutrition Requirements Across the Life Span	
Life Span Period	Nutrition Requirements
Pregnancy (includes nursing mothers)	Approximately 300 additional calories are required each day for increased energy needs. Weight gain should average between 24 to 28 pounds during pregnancy. A well-balanced, nutritious diet is important because of the increased need for protein, vitamins, and minerals. The diet should include more milk products and more fruits and vegetables.
Infancy (Birth through 1 year)	Most of the infant's nutritional needs during the first year are met through human milk or infant formula. Formulas contain amounts of protein, vitamins, and minerals recommended by the American Academy of Pediatrics. Some formulas are iron-fortified. It is not recommended that solid foods be given to infants until four to six months of age.
Early Childhood (2 years through 5 years)	Childhood obesity and iron-deficiency anemia are the two nutritional problems most commonly diagnosed during childhood. Children should be fed nutritious foods at every meal. Breakfast is especially important, and nutritious snacks help meet the child's daily nutrient needs. Iron-fortified breakfast cereals and lean meat help supply daily iron requirements.
Middle Childhood (6 years through 11 years)	Children should be encouraged to eat a variety of nutritious foods at mealtime and snack time in order to meet their daily nutritional needs for growth and development. Children of this age can learn to choose healthy foods. Snack foods may need to be monitored at this time because consumption of sugary foods and empty calorie foods increases during this stage.
Adolescence (12 years through 19 years)	Rapid growth periods occur in girls between the ages of 10 and 13 years, and in boys between the ages of 12 and 15 years. Consumption of well-balanced, nutritional meals is important during these years. An increased need for calcium occurs due to rapid bone growth. Teens need to increase their intake of foods from the milk group. Poor food choices during adolescence lead to calcium deficiency, iron-deficiency anemia, and excessive intake of saturated fats, sugar, and empty calorie foods.
Young Adulthood	It is important for young adults to realize that the food choices, health practices, and lifestyle decisions made in the young adult years have significant effect on health and wellness in later life. Eating a well-balanced diet and exercising on a regular basis are good beginnings for young adults. Iron and calcium intakes are very important.
Middle Adulthood (40 years through 65 years)	Adults in this stage need to follow the guidelines for good health and disease prevention. These guidelines recommend that people should eat a variety of foods, maintain desirable weight, avoid too much fat, saturated fat, and cholesterol, increase intake of foods with sufficient starch and fiber, avoid eating too much sugar and sodium, exercise regularly, refrain from smoking and consuming alcohol, and try to limit undue stress.
Older Adulthood (over 65 years)	A healthy diet can help reduce some of the effects of aging. Poor nutritional health at this stage can affect the severity of disease, as well as affect mental function. Some guidelines for nutritional health for older adults include four to six small meals eaten frequently, sufficient intake of vitamins B ₆ , B ₁₂ , thiamin, C, D, E, and the minerals calcium, iron, and zinc is important. Regular exercise is needed to stimulate appetite and food intake. Significant weight loss can increase risk of death following illness or disease.

Table 5.1

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Daily Food Guide for the Expectant Mother	
Food	Number of servings
Milk and milk products	3-4
Meat and protein-rich foods - Include: Animal protein Vegetable protein (dried beans and peas)	3
Fruits - Include: Vitamin C-rich fruits	3
Vegetables - Include: Dark green vegetables	4
Bread and Cereals Whole-grain, enriched breads and cereals	7-11

⇐ Table 5.2

for the synthesis of DNA (material in the cell that contains the genetic code) and red blood cell formation. Food sources of iron include the following:

- dark green vegetables
- dried fruits
- fish
- legumes
- liver
- oysters
- red meat

Sources of folate include the following:

- asparagus
- beets
- broccoli
- romaine lettuce
- orange juice
- spinach
- turnip greens

The best advice for young women of childbearing age is to practice good nutrition during adolescence and the years before conception. Also, prenatal care through a clinic or by a physician can help reduce the risks of problems during pregnancy, labor, and delivery.

Infancy and Early Childhood

Good nutrition helps infants and children to grow and develop normally. The first year of life is the most important stage in the life span. An infant's nutrient requirements per unit of body weight are higher than the needs of an adult. Growth rate varies, but a normal healthy infant could gain two to three pounds per month in the first six months. By the first birthday, the infant's weight has almost tripled. Energy needs vary somewhat, but usually decrease slightly after the first year.

Infancy. Milk is the infant's most important food. Experts contend that breast-milk is best because it is easily digested. Breast milk contains immunities from the mother that help a baby resist infection. Also, it helps protect the baby from allergies. A *lactating* (breast-feeding) mother should follow the same guidelines for good nutrition as during pregnancy, and drink plenty of liquids. Good nutrient-rich food choices will ensure enough milk and satisfy the baby's nutrient needs.

For mothers who choose not to breast-feed their babies, food technologists have engineered commercial formulas much like human milk, affording the infant with nutrients needed to grow and develop. Usually, formulas are made from cow's milk, but there are formulas available made from a soybean base for an infant who is allergic to cow's milk.

Babies should not be given soft drinks, sugar water, coffee, tea, and diet beverages. Also, honey may contain microorganisms harmful to infants. Parents should be careful

not to feed babies foods like nuts, popcorn, raw carrots, or peanut butter that can cause choking.

Experts recommend introducing babies to solid food between six and twelve months of age. Babies start with strained foods and then move to "finger foods" as they grow older and their teeth come in by their first birthday. Most babies can eat the same foods as the rest of the family. Fat intake should not be limited in the first two years because of high-energy requirements.

Early Childhood. Growth for early childhood is rapid. Each child has different nutrient needs, depending on individual growth and activity, but continuous weight gain is a sign of sound nutrition. Following the Food Guide Pyramid for Children is important so that their diets supply necessary nutrients. Figure 5.3 shows the *Food Guide Pyramid For Young Children* with recommended servings for each food group.

Toddlers and pre-schoolers often are particular about food choices, so parents should set up a pleasant eating routine at the table with small utensils. Nutrition experts agree that toddlers will make up for not eating at one meal at the next meal. Toddlers will eat more nutritionally by eating several "mini" meals instead of three traditional meals. Parents should focus on providing a diet that includes all necessary nutrients and be flexible on the "how and when" of toddler's food consumption.

Because of high-energy needs and rapid growth, children need nutritious snacks. Snack foods not only contribute to daily nutrient needs, but also contribute to the total number of calories consumed. Parents and caregivers should avoid providing foods that are high in sugar, salt, and fat. Refer to Figure 5.4 for nutritious snack suggestions for children.

Promoting Good Eating Habits in Young Children. Children are often sensitive to texture, shape, and color of food. Some children develop strong opinions about certain foods early in life that may affect good nutritional habits. Making nutritious foods attractive and fun will encourage good healthy eating habits.

The following are tips for parents to enhance nutritious eating habits:

- Get children involved in meal planning and preparation.
- When possible, give children several choices of nutritious foods and/or snacks.
- Avoid stress and negative conversation at mealtime; make mealtime pleasant.
- Model nutritious eating habits.
- Avoid using food to reward or punish behavior; this can send negative messages about the purpose of food which can lead to poor eating habits.
- Serve a variety of color, texture, and flavor in food choices. If foods are attractive, children will try new things

◆ Essential Questions: ◆ Infancy and Early Childhood

1. Why are nutrients so important in the early development of children?
2. How can a lactating mother make sure she and her baby are healthy?

The School-age Child

Lifetime food habits developed between ages six through twelve will impact an individual's overall health. It is important to stress the breakfast meal to growing elementary age children. Breakfast provides the body with one-fourth to one-third of the day's total nutrients. Research has shown that children who eat a nutritious breakfast perform better in school than those who skip breakfast.

Food Guide Pyramid For Young Children

A Daily Guide
for
2-6 Year Olds



Source: USDA Center for Nutrition Policy and Promotion.

⇒ Figure 5.3

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Nutritious Snack Suggestions for Children

Vegetables such as broccoli and cauliflower florets, carrot sticks, celery sticks, cucumber slices, cherry tomatoes, and green pepper slices can be eaten alone or with dips made from low-fat yogurt or low-fat cottage cheese.

Fruits that are easy to "take along" make good snacks, including apples, bananas, grapes, nectarines, oranges, peaches, pears, plums, raisins, and tangerines.

Breads and cereal products are easy to serve as snacks. Include bagels, crackers, finger sandwiches, muffins, popcorn, pretzels, and tortillas in the list of snack choices. Children enjoy making shaped sandwiches by cutting bread into shapes with cookie cutters.

Milk beverages and milk products, such as cheese and yogurt, are nutritious snack choices. Also included in this group are cottage cheese, frozen dairy products made with low-fat milk, and puddings. Adding fresh fruit to plain, low-fat yogurt makes a great snack and is lower in fat and calories than commercial frozen yogurts.

Meat group foods can be snack foods too. Tuna fish and peanut butter can be served with crackers or used as the filling for finger sandwiches. Nuts and seeds provide protein in the form of a crunchy, ready-to-eat snack.

Figure 5.4



It is important for children to eat a healthy breakfast, lunch, and dinner with selections and portions recommended by the Food Guide Pyramid, in order to meet their nutritional needs.

Childhood Obesity. Obesity is common among children in America. Obesity is a condition characterized by excess body fat. Children do not always have the educational background to make nutritional choices that are sound, so parents and caregivers must encourage children to be physically active and

to eat healthy meals and snacks. Some children may try and lose weight by restricting foods that are essential to support growth. Parents should consult a nutrition expert or dietitian before addressing problems in a child's diet.

◆ Essential Questions: ◆ The School-age Child

1. Why is breakfast so important for school-age children?
2. How is obesity defined?

Nutrition in the Teen Years

The teen years are a period of rapid growth spurts. **Growth spurts** (periods of rapid physical growth in boys and girls) vary in length and intensity, but both boys and girls need more energy and extra nutrients in

their diet. Dietary studies show that teens do not get enough vitamin C, vitamin A, calcium, and iron. While teenagers may know the basics of healthy nutrition, busy schedules, lack of discipline, and unrealistic body perception can negatively affect the food choices they make. The following facts relating to teenagers and nutrition are important to consider:

- Obsessive dieting can stop teens from growing to their full height.
- Teens can manage their weight with proper diet and exercise.
- The bones take in the most calcium during the teen years and early twenties.
- Girls lose iron during their menstrual period and may feel weak and tired.
- Good nutrition helps individuals feel good and look good.
- Food and exercise patterns formed in the adolescent years affect long-term health.
- Fast foods like pizza and hamburgers provide nutrients but tend to be very high in calories, fat, and sodium.
- Salads, pastas, fruits, and vegetables are good choices when eating out.
- Chocolate, greasy foods, and colas do not cause acne.
- Nutrition plays a vital role in performance of athletes.
- Drinking plenty of water is essential for teens, especially athletes.
- Breakfast is important because it replenishes energy after sleeping.

The Food Guide Pyramid applies to family members at all stages in the life span. The essential message of variety, balance, and moderation in choosing foods apply to the teenager as well. The only adjustment may need to be in the amount of servings from each group. Teens need more energy and should eat more from the bread and cereal (complex carbohydrates) section. Also, teens need to choose foods which are iron (*meat and vegetable group*) and calcium (*milk group*) rich.

Teenagers, especially girls, who fail to consume enough calcium put their bones at risk for the long term. Girls, more than boys, are concerned about body fat and can deprive their bodies of needed calcium and begin their adult years calcium deficient. The milk group foods include cheese and yogurt, which are loaded with calcium.

Teenagers typically are low on iron in the blood. Iron is a part of the hemoglobin in the blood which carries oxygen to the cells to help produce energy. Teenagers may experience chronic fatigue due to a short supply of iron. Good sources of iron include enriched grains, legumes, seafood, meats, and poultry.

Teens are especially concerned about being in good shape physically. There are benefits of establishing lifelong habits of exercise and physical activity in the adolescent years. The goals set for fitness and nutrition now will reduce the risk for chronic health problems later.

◆ Essential Questions: ◆ Nutrition in Teen Years

1. What are some common myths related to sound nutrition for teenagers?
2. What health problems due to lack of calcium can occur with teenage girls?

Nutrition in Adulthood

Adults need the same essential nutrients as children and teenagers. Nutrients support the vital body functions, give energy, and build and repair cells. Again, choices from the Food Guide Pyramid provide a nutritious diet for a healthy adult. Most adults are less active and require fewer calories, so food choices should be low-fat and low calorie.

Because of the many demands of work and family, it is easy for adults to neglect sound nutrition and exercise habits. Busy

schedules and demands on time lend to eating fast food on the run and making high calorie choices. Advance planning of meals and snacks promotes healthier food choices. Also, adults who are less active and tend to eat as much as when they were younger, gain weight and can develop other serious diet-related health problems.

Four of the ten leading causes of death and disease in the United States are associated directly with diet. Many other health related problems are connected with diet. Heart disease, high cholesterol, high blood pressure, cancer, osteoporosis, gum disease, and diabetes are discussed in chapter six. It is important to understand diet-related health problems that require people to greatly modify their diets. It is important for a dietitian to oversee diet and food plans during treatment and prevention of medical conditions. For example, research has shown a strong link to diet and cancer. Reduction of cancer risk by diet requires an overall change in eating patterns and food preparation methods. For example, the American Cancer Society has recommended the following guidelines for the public:

1. Choose most of the foods you eat from plant sources.
2. Limit intake of high-fat foods, particularly from animal sources.
3. Include a variety of vegetables and fruits in the daily diet
4. Be physically active: achieve and maintain a healthy weight.

Nutrition and Aging

Aging is a natural process that is designed into the genes at conception. It occurs as a normal progression of the life cycle. Nutritional needs change during the various stages of the life cycle.

This section deals with the nutritional needs of older adults and the implications their nutritional needs have on overall health and well-being.

Due to increased health awareness and advances in medical science, Americans are living longer than ever before. It is anticipated that by the year 2050, the percentage of the population age eighty-five years and older will increase to more than 5 percent of the total U.S. population. There is certainly a need for more nutrition education and guidance for this segment of the population and their families.



The older adult population varies from those who maintain healthy, independent lifestyles to those who are suffering from disabling illnesses and require institutional care. Certainly those who are ill have special nutritional needs, but those who live independently also have different nutritional needs than they did in their younger years. Helping older adults develop healthy eating practices that meet their daily energy and nutrient needs can improve their general health, energy levels, and self-esteem, and it may reduce the risk of other health problems in the future.

Numerous social and psychological factors affect the eating practices of older adults. Many senior adults must adjust to being alone after the death of a spouse with whom they had shared fifty or sixty years. This new adjustment brings about loneliness, despair, and a lack of motivation to prepare and eat nutritious meals. Senior citizens also may face financial difficulties and/or physical disabilities. Persons who have reached this stage of the life cycle without establishing a regular routine of exercise may suffer from loss of appetite due to lack of physical activity.

Diets of older adults often contain too many carbohydrates and not enough fruits, vegetables, meats, and dairy products. Foods such as breads, crackers, sweet rolls, cereals, and cookies may make up a large portion of their diet. Older adults seem to prefer these foods because they are less expensive, do not require refrigeration or preparation, and are easier to chew than meats, fruits, and vegetables.

This high carbohydrate diet indicates that senior adults' diets may be lacking in several important nutrients. Figure 5.5 lists nutritional needs of older adults. Older adults with illnesses and other health problems may have different dietary needs.

Communities have several social programs to help older adults. Senior citizen centers offer meals at reduced cost and an opportunity for socializing. The *Meals on Wheels* program enlists volunteers to deliver hot meals to senior adults who are ill, handicapped, or just unable to cook for themselves. *Congregate Feeding Programs* at Senior Citizen Centers provide nutritious hot meals every day as well as a social gathering place for these older adults. It is believed that the social and psychological impact of eating alone and cooking for one are the major factors affecting malnutrition in many older adults. Family members can help by planning special outings and family meals that include the older adults in their family. Activities that allow the older adults to interact with others help to eliminate some of the loneliness and help to motivate them to take better care of their health needs.

The need for water is often neglected in an older adult's diet because the body's thirst signal declines with age. Older adults need to drink six to eight glasses of water daily even though they may not feel thirsty.

◆ **Essential Questions:** ◆
Nutrition in Adulthood

1. How do the nutritional needs of adults compare to the nutritional needs of teenagers?
2. What social and psychological factors affect the eating practices of older adults?

Becoming familiar with each life span period helps plan nutritious family meals. From the prenatal period to older adulthood, poor nutrition causes health problems. Understanding the special needs of each stage assists in planning family meals and encouraging family members to make wise food choices. See Figure 5.6.

SPECIAL DIETARY NEEDS

In the last decade, the American population has taken a serious look at health and health issues. The relationship between lifestyles, daily diets, and health and fitness has become a topic of conversation and confusion for many people. Media attention to all types of special diets has caused conflicting information. Special mention of adapted meal-planning guidelines for various situations will help clarify special diets familiar to the public.

Vegetarian Diets

A *vegetarian diet* is a diet made up partly or wholly of plant foods. Some people in developing countries cannot afford animal foods, while others abstain from animal foods for religious reasons. In America, many choose a vegetarian diet for ethical reasons, while a few individuals eat strictly vegetarian because it is trendy and popular.

Nutritional Needs of

Older adults may need to increase intake of the following:

- + **Protein** is an essential part of cells; it is used for energy if needed.
- + **Iron** helps prevent anemia.
- + **Calcium** helps prevent osteoporosis.
- + **Vitamin A (retinol)** prevents blindness; increases defense against bladder, lung, and skin cancer.
- + **Vitamin C (ascorbic acid)** strengthens connective tissues, helps with iron absorption, and calcium.
- + **Folate** is important for growth of new cells, protein metabolism, and formation of red blood cells.
- + **Fiber** aids in the prevention of constipation, appendicitis, diverticulosis, colon cancer, atherosclerosis, and hemorrhoids.

Older adults may need to decrease intake of the following:

- [**High-fat diets** are associated with an increased risk of arthritis, cancer of the breast and colon, gallbladder disease, heart disease, and obesity.
- [**Sugar** is associated with tooth decay and obesity.
- [**Sodium** is associated with fluid retention and high blood pressure.

⇒ **Figure 5.5**

Lacto-ovo vegetarians eat plant foods, dairy products, and eggs. This type of vegetarian diet can get all necessary protein from legumes, nuts, and grains. They must consciously select plant foods that are rich in iron, zinc, and B vitamins.

Pure vegetarians, or "vegans" refrain from eating any animal foods. Vegans are usually deficient in vitamin B₁₂, Vitamin D, riboflavin, calcium, and protein. Children and pregnant and nursing women can rarely obtain the increased need for calcium without consumption of dairy products.

Guidelines for Athletes

The Food Guide Pyramid is a great nutritional guide for the athlete. The performance of an athlete is directly related to the role

nutrition plays in his/her everyday eating habits. Complex carbohydrates are an excellent source of energy. Many trainers and coaches recommend pasta, such as spaghetti, for a pre-game meal. Foods high in fat should be avoided before athletic events because fat stays longer in the stomach and the energy is used in the digestive process instead of for the athlete's performance.



Athletes need recommended amounts of protein for growth and repair of muscle tissue. Meal planning for athletes also must include increased amounts of water. Water should be consumed before, during, and after

Making the Menu Fit the Family

Nutrient and calorie needs vary from person to person, depending on age, sex, body size, and activity level. But even if your household contains people with different needs, you usually don't have to plan different menus for each person.

First, plan your daily menus to include at least the lower number of servings of foods from each group. Pick foods from all subgroups regularly. Then, adjust your menus for family members who need different amounts of food:

▲ **Provide larger or smaller portions of menu items.** For example, one-half cup cooked rice counts as one serving from the grains group; 1 cup of rice counts as two servings. A young child could have a smaller portion, about one-fourth to one-third cup.

▲ **For those who need more servings,** include additional foods in meals or snacks—a piece of fruit, a peanut butter sandwich, crackers and cheese, and so forth.

Here are some other tips for planning for different family members.



▲ Toddlers and young children

Serve young children the same variety of foods as everyone else, but in smaller amounts to suit their smaller needs. They should have the equivalent of 2 cups of milk each day, but you can serve it in three or four portions. Because small children often eat only a small amount at one time, offer them nutritious "meal foods" as snacks—milk or fruit juice, cut-up fruit, vegetable sticks, strips of cooked meat or poultry, whole-grain crackers and peanut butter, half a sandwich and so forth. To get enough calories to grow, many young children may need higher calorie foods such as whole milk.



▲ Children

Energy needs vary widely for elementary school children. They should eat at least the lower number of servings from each group. If they need more calories, increase the amount of food from the first five groups. Go easy on foods from the fats and sweets group.



▲ Teenagers

All teenagers need three servings of milk, cheese, or yogurt to meet their calcium needs. Teenage boys often need a lot of food. They can eat the higher number of servings from each food group. (With a moderate amount of fat and sugars, this supplies about 2,800 to 3,200 calories.) Some very active boys need even more. Encourage them to eat more foods from each of the first five food groups and to go easy on the sixth food group—foods high in fat and sugars.

Teenage girls usually need more food than the lower number of servings, especially when they are active or growing rapidly. They should increase their servings from the first five food groups. Teenage girls who are active participants in vigorous sports may need the higher number of servings or more. Encourage physical activity rather than repeated dieting to help control weight.



▲ Adults of all ages

Adults should have at least the lower number of servings from each food group. With a moderate amount of fat and sugars, this number of servings provides about 1,600 calories—about the right amount for a sedentary woman and some older adults. However, most adults will need more calories than this, depending on body size and physical activity. Most men can have the middle to upper number of servings in the ranges. The lower to middle numbers of servings in the ranges are more appropriate for

most women. Regular exercise is important to maintain fitness. It also allows you to eat more food to supply the nutrients you need without gaining unwanted weight. Total food intake is most important in weight control, but increasing physical activity helps.



▲ People with special needs

Women who are pregnant or breastfeeding need to include at least three servings of milk, yogurt, or cheese to meet calcium needs. (Teenagers who are pregnant or breastfeeding should have four servings). They should eat more breads and cereals, fruits, vegetables, and meat and meat alternates, too. To meet higher needs for many vitamins and minerals during pregnancy, many physicians also prescribe a multi-vitamin and mineral supplement.

Toddlers, teenage girls, and women of childbearing age may not get all the iron they need from the amounts of food they eat. Be sure to include good sources of iron such as lean red meats, dry beans and peas, dark-green leafy vegetables, whole-grain and enriched breads, and iron-fortified breakfast cereals. Meat and the vitamin C in fruits and vegetables can help the body use the iron in iron-containing foods eaten at the same meal.



▲ Older people

Older people vary in their dietary needs. Many can eat like younger adults. Some elderly people eat relatively little food. They need to eat foods from each of the first five food groups, but they should eat less of foods in the sixth group—fats and oils, sugars and sweets, and alcoholic beverages. Elderly people or others who are on medication for treatment of chronic conditions may have vitamin and mineral supplements or special diets prescribed by their physicians. A dietitian can help you adjust your family menus to meet special dietary needs of these individuals.

Source: "Preparing Foods and Planning Menus," Home and Garden Bulletin No. 232-8, United States Department of Agriculture Human Nutrition Information Service, U.S. Government Printing Office, Washington, D.C. p. 10.

Figure 5.6

athletic events to replace the water loss through sweat during training and competition. The performance and health of athletes may suffer because of dehydration. Many teams choose sports drinks to replace lost fluids, but these drinks sometimes contain excess sodium and sugar not needed, so exercise physiologists feel that plain water is a better choice for athletes.

Besides increased amounts of water for the athlete's diet, the high level of activity increases the need for calories. Sixty-five percent of calories should come from breads, cereals, pasta, rice, and starchy vegetables. Athletes should choose lean meats, poultry, and fish for protein needs. Athletes and others who are physically active need to eat low-fat dairy products to meet calcium requirements and a variety of fresh fruits and vegetables to provide vitamins, minerals, and fiber. The above description of the athlete's diet mirrors the Food Guide Pyramid daily recommendations.

Nutritionists warn against nutrient supplements for athletes unless a physician or registered dietitian is consulted. Research has shown some supplements to be ineffective, costly, and unhealthy.

Weight-gain Diets

Little is written about "weight gain" diets, but there are underweight persons who need sound nutritional guidance in trying to gain weight. It is important to consult a physician because usually there are medical reasons why a person is underweight. Sometimes emotional problems contribute to weight problems. If there is no medical or psychological problem causing weight loss, a dietitian can help the underweight individual plan a diet that is both appealing and aids in weight gain.

To gain weight, the body must consume more energy than it burns. Making choices from the Food Guide Pyramid is nutritionally

sound. Caloric intake can be increased by eating more servings from the five food groups, and increasing the number of meals up to six or seven per day.

While eating no more than 30 percent calories from fat, the underweight individual should choose foods with concentrated calories like soups and casseroles using milk as the base. Fruit and yogurt shakes make a great bedtime snack and also aids in weight gain.

Stressful topics discussed at mealtime can affect appetite. Family members should agree in advance that conversation at mealtime should not be centered on conflicts, problems, or emotional issues.

Exercise is an important daily activity for all individuals, including those who need to gain weight. A short, brisk walk or other exercise before mealtime can improve appetite and boost energy needed for eating. Successful weight gain practices for underweight individuals should follow a diet recommended by a registered dietitian or physician that incorporates regular exercise and involves relaxed mealtimes with family and friends.

Weight-loss Diets

Many Americans are continually being challenged with maintaining ideal weight throughout adulthood. Research has shown that serious overweight problems lead to many health problems such as coronary heart disease, diabetes, gallbladder disease, high blood pressure, respiratory problems, and stroke. Overweight individuals also face problems with fatigue and degenerative arthritis.

Once a person has a serious weight problem, finding solutions to weight loss become more of a challenge. It is more difficult to lose excess weight than it is to maintain ideal weight in the beginning. Weight loss will only occur as a result of expending more calories

through exercise and activity than is consumed through food. Eating habits and eating behavior must be changed in order to maintain the ideal weight once the excess weight is lost. Because weight loss is so difficult, many look for quick fixes to the overweight problem. The following are some of the most popular "quick-fix" diet plans:

- magical food diets, like the "Grapefruit diet," "Rice diet," or "Cabbage soup diet"
- high-protein diets
- high fiber, low calorie diets
- low calorie liquid diets

There are problems with all of these popular weight-loss diets. The problems range from lack of variety and inadequate amounts of nutrients for the body to long-term damage to health and even possible death.

Fad diets like the ones mentioned above cause many disappointments for their followers such as the following:

- disillusionment
- loss of money (from buying special foods, gadgets, and remedies)
- unsuccessful weight loss
- weight cycling (having a yo-yo effect of losing and gaining weight)
- weight gain with an increase of body fat

These "quick fix" diets or fad diets will fail because they are not nutritionally balanced. They provide only a temporary solution to a permanent problem. Unless a weight-loss eating plan is nutritionally sound and helps to change life-long eating habits, it is doomed to fail.

On the other hand, effective diet plans that are prescribed and conducted under the supervision of registered dietitians and physicians provide the overweight individual with a much better chance at success. Some characteristics of effective diet plans include the following:

- nutritionally-balanced meal plans.
- methods for teaching new eating habits.

- menus that offer choices of a wide variety of foods.
- meal plans that include a balance of calories (the recommended proportion of carbohydrate, fat, and protein).
- satiety value which keeps the person feeling satisfied and delays hunger for a period of time.
- an average of 1,200 calories per day for adult women and 1,500 calories per day for adult men (less than 1,000 calories per day will not provide the needed nutrients and will most likely leave the person feeling tired and hungry).

Weight control and weight loss in children and adolescents must be carefully monitored by physicians. Due to the rapid growth and development that occurs during these years, it is imperative that any weight loss programs for children and adolescents be prescribed and supervised. Rapid weight loss and calorie restriction in children and adolescents can cause serious health hazards.

◆ Essential Questions: ◆ Special Dietary Needs

1. What type of eating plan should athletes follow?
2. What are some the pitfalls of weight loss diets?

MEAL PLANNING ON A BUDGET

A **budget** is a spending plan that helps individuals manage money. Budgeting involves balancing income with expenses. A budget helps to estimate how much money needs to be set aside for housing, food, clothing, transportation, health care, and savings. According to research, about 15 percent of family income is spent on food. The percentage may vary depending on total income.

EXAMPLE OF HOW A FAMILY SPENDS ITS INCOME

HOUSING	30%
FOOD	15%
CLOTHING	6%
TRANSPORTATION	18%
HEALTH	5%
INSURANCE	9%
MISCELLANEOUS	17%

Food expense can be a large portion of the family's overall budget. With the makeup of the family unit continuously changing, many factors affect the amount of money spent on food. Every family is different and considerations vary when creating a food spending plan. The main factors that affect the amount of money spent on food include the following:

- the size of the family
- the age of the family members (teenagers cost more)
- the number of people in the family
- food prices
- eating out practices
- time and skill available to prepare foods at home

When planning menus, a well-thought out food budget will aid in making the most of the food dollars available. Begin by simply keeping a record of monies spent on groceries and eating out. After a short period, categories will be apparent and a pattern of spending will be evident. Next, decide how and what needs to change regarding food expenditures.

Once an amount is set for the food budget, it is important to stick to it. After using the food budget for several weeks, families should evaluate the spending record and make necessary changes.

The following strategies will aid in planning nutritious meals within the food budget:

- Plan menus based on weekly supermarket specials.
- Comparison shop for food items.
- Use coupons.
- Buy generic or store brands when acceptable for the purpose.
- Plan menus around fruits and vegetables in season.
- Use meat extenders.
- Purchase bread and bakery products at bakery thrift stores.
- Avoid impulse buying.
- Avoid shopping when hungry.
- If possible, avoid shopping with children.



Remember the cost of food has little bearing on its nutritional value. Each group in the Food Guide Pyramid includes many nutritious food items. A T-bone steak is more costly than ground beef, but both provide similar nutrients. A skillful menu planner is armed with the Food Guide Pyramid and a well-thought out food budget. Careful planning can benefit the overall nutrition and health of each family member.

◆ **Essential Questions:** ◆
Meal Planning on a Budget

1. What factors help determine the amount of money a family spends on food?
2. What are the steps in setting up a food budget?
3. What are five strategies for planning nutritious meals within the family food budget?



Chapter Highlights

- ☆ Helping older adults develop healthy eating practices that meet their daily energy and nutrient needs can improve their general health.
- ☆ Nutrition standards are based on scientific research and help individuals make wise food choices that promote good health and reduce the risk of disease.
- ☆ In 1992, the United States Department of Agriculture and Health and Human Services developed the *Food Guide Pyramid*, a guide to daily food choices.
- ☆ Many young women do not realize that nutritional health during the years before they become pregnant has as effect on their pregnancy and the development of the fetus. The decisions the expectant mother makes about nutrition will affect her baby's health and its future.
- ☆ Nutritional needs change during the various stages of the life span. The varying stages of growth that take place from infancy through adolescence and adulthood make different demands on the body's nutritional health.
- ☆ Nutrient density refers to foods that are excellent sources of essential nutrients but are low in calories.
- ☆ Growth for early childhood is rapid. Each child has different nutrient needs, depending on individual growth and activity, but continuous weight gain is a sign of sound nutrition. Following the Food Guide Pyramid for Children is important so that their diets supply necessary nutrients.
- ☆ Research has shown that children who eat a nutritious breakfast perform better in school than those who skip breakfast.
- ☆ Dietary studies show that teens do not get enough vitamin C, vitamin A, calcium, and iron. While teenagers may know the basics of healthy nutrition, busy schedules, lack of discipline, and unrealistic body perception can negatively affect the food choices they make.
- ☆ When planning menus, a well-thought out food budget will aid in making the most of the food dollars available.

Chapter 6

Diet-related Diseases and Disorders



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 1B Analyze the relationship of nutrients and other factors to diet-related diseases and disorders.
- 5B Develop examples of therapeutic diets.
- 5C Explain consequences of eating disorders on long-term health.



Chapter Vocabulary

anaphylaxis	hypertension
anorexia nervosa	lactose intolerance
atherosclerosis	obesity
bulimia	osteoporosis
cardiovascular disease	preventive nutrition
cholesterol	therapeutic diets
diabetes	wellness
eating disorders	

NUTRITION AND WELLNESS

Wellness can be defined as the state of being in good health. When people are in good health they have energy and a positive outlook on life. They are ready to meet the challenges of the day. Good health improves the quality of life.

One major impact on wellness is nutrition. Nutrients are the basic components of food that nourish the body. Health experts know that diet and eating patterns directly affect overall health and wellness. Nutrition plays an important role in the prevention and treatment of certain diseases and health problems. The body's ability to resist disease is directly related to nutritional health. Nutrients

Wellness Secrets:

found in food are essential for overall health and well being. Although nutrients do not cure an illness as medicines do, the well-nourished body is better prepared to fight disease and keep itself healthy. **Preventive nutrition** is the process of maintaining good health and wellness through good nutrition practices before illness occurs. Health and nutrition experts have developed several tools for you to use to practice good nutrition in planning meals and making wise food choices.

◆ Essential Questions: ◆ Nutrition and Wellness

1. What is the relationship of wellness and nutrition?
2. What is preventive nutrition?

DISEASES AND HEALTH PROBLEMS LINKED TO NUTRITION

Advances in medical science have shown an increasing relationship between the food consumed and good health. Doctors and dietitians also know the many ways diet is related to disease and recovery.

Nutrition and the Common Cold

Many people believe that consuming large amounts of a certain food or taking large doses of vitamin supplements will cure an illness or disease. For many years, it has been rumored that consuming large doses of vitamin C (ascorbic acid) will prevent or cure the common cold. Scientific research indicates that large doses of vitamin C have no effect on the virus that causes colds.

Since vitamin C is a water-soluble vitamin, amounts above the body's daily need is excreted through the urine. However, it has been shown that mega doses of vitamin C, above 2 grams, can be harmful. Two grams of vitamin C are equivalent to 2,000 milligrams. The RDA for vitamin C for teens and adults is 60 milligrams; therefore, a person who takes four 500 milligram vitamin C tablets is consuming three and one-half times the recommended amount. The person whose diet meets the minimum daily requirement of nutrients will most likely suffer less severely from colds, and the person will possibly recover sooner.

Nutrition and Cancer

Research has shown that diet and nutrition are related to cancer in several ways. It is evident that people's eating habits influence their susceptibility to certain kinds of cancer. However, there are many factors involved when considering the cause, prevention, and recovery from cancer. Besides diet and nutrition, genetic and environmental factors also are known to be involved. The challenge for researchers is to continually compare the dietary practices of those persons who get cancer with those who do not. One factor is clear, the risk of developing cancer may be greatly reduced in persons who make wise food choices and reduce or eliminate alcohol and tobacco consumption.

There are foods related to cancer: foods that are known to promote cancer growth and foods that are believed to prevent or retard the growth of cancer in the human body. Most recent studies show the direct relation of a low-fat, high-fiber diet to a reduced risk of breast, colon, and stomach cancers.

Research on cancer risk and diet suggests that people can modify their food choices to reduce their risk of developing cancer. Choosing a wide variety of nutrient-rich foods as well as reducing fat intake and increasing intake of fiber-rich foods is a prescription for healthy eating.

Nutrition and Heart Disease

It is estimated that more than half of the people who die in the United States each year die of cardiovascular disease. **Cardiovascular disease** is a term that covers all the diseases of the heart and blood vessels. Most of these deaths can be attributed to atherosclerosis.

Atherosclerosis is a hardening of the arteries characterized by a thickening of the artery walls with plaques. Plaques are mounds of lipid matter that accumulate on the inner walls of the arteries. Lipid is a term used to describe fats, oils, and fat-related substances. Atherosclerosis leads to the closing or blocking of the arteries that supply blood to the heart and brain. Obstruction or blockage in the arteries can cause heart attacks and strokes.

Most people have some plaques in their arteries. The important factor is how advanced the buildup is and what can be done to slow down its progression. Certain factors have been identified as risk factors in relation to atherosclerosis. These factors include the following:

- **Smoking.** Smoking is considered one of the causes of heart disease. Smoking reduces the level of HDL cholesterol; HDL is the good cholesterol.
- **Gender.** Males are more prone to heart disease than females.
- **Heredity.** Persons with a family history of heart disease and diabetes have a greater risk.
- **High blood pressure.** Also known as hypertension, high blood pressure is a major risk factor in heart disease and strokes.
- **Lack of exercise.** Regular exercise helps control weight, reduces stress, and improves circulation.
- **Obesity.** Obesity causes increased stress on the heart and other organs and increased levels of serum cholesterol.
- **Stress.** There appears to be some link to person's personality, reaction to stress, and heart disease.
- **High blood cholesterol level.** Blood cholesterol levels that are over 200 milligrams per 100 milliliters of blood are considered high.
- **Personality characteristics.** Type A behavior. Type A personalities are most generally competitive, tense, withhold emotions, and resists fatigue.

By identifying and controlling the risk factors that are present in one's life, a person can slow the progression of atherosclerosis. Good nutrition, along with the other factors, plays an important role in preventing heart disease. Research has shown that it is a combination of the risk factors, rather than just any one in particular, that makes some persons more susceptible to heart disease than others.

Along with the dietary goals for reducing the risk of coronary heart disease, other lifestyle changes also reduce the risk. These are identified in Figure 6.1

Lifestyle Changes that Reduce the Risk of Heart Disease

- **Stop smoking.**
- **Reduce blood pressure through diet or medication.**
- **Reduce body weight if needed.**
- **Increase exercise and activity.**
- **Reduce stress and enjoy life.**

Figure 6.1

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Americans are striving to become a healthier population. More people than ever before are taking an interest in their nutritional and overall health and well-being. Hopefully, this will lead to a drastic reduction in the number of deaths from cardiovascular disease.

Cholesterol. In recent years, cholesterol has received much media attention and has become a household word. *Cholesterol* is an odorless, soft, fat-like substance found in every cell in the body. Cholesterol performs several functions in the body. These include the following:

- to aid in digestion
- to contribute to the structure and function of cell membranes
- to assist in the manufacture of vitamin D (calciferol) and hormones



It is not necessary to eat foods containing cholesterol because the liver makes most of the cholesterol that the body needs. Even though cholesterol is found in every cell in the body and is necessary for its function, it also makes up the main part of the plaques that block the arteries in atherosclerosis. There are certain dietary goals that prove to be beneficial in lowering blood cholesterol levels. These dietary goals for lowering blood cholesterol are described in Figure 6.2.

Dietary Goals for Lowering Blood Cholesterol Levels

1. Reduce total fat intake to 30 percent of total calories.
2. Include more whole grains in the daily diet.
3. Eat fish more often.
4. Increase consumption of fiber-rich fruits and vegetables.
5. Add the many varieties of legumes to the daily diet more often, such as dried beans and peas and soybeans.
6. Include nonfat or low-fat milk and milk products every day.
7. Reduce the cholesterol-rich foods in the diet, especially organ meats, egg yolks, shellfish, and fatty red meats.

Figure 6.2

Cholesterol travels through the bloodstream in lipoproteins. Lipoproteins are lipids combined with proteins that transport lipids in the blood. There are two types of lipoproteins that transport cholesterol throughout the body. The two types are low-density lipoprotein (LDL) and high-density lipoprotein (HDL).

Low-density lipoproteins (LDL) carry cholesterol from the liver throughout the body but do not return the cholesterol to the liver. Therefore, cholesterol remains in the arteries and can cause a buildup in the artery walls. High-density lipoproteins (HDL) clear excess cholesterol from the arteries and carry it back to the liver where it is processed and removed from the body. LDL is often called "bad" because of its inability to remove cholesterol from the bloodstream. HDL is often called "good" because of its ability to prevent cholesterol and fat deposit buildup in the artery walls. It is this buildup of cholesterol plaques that contributes to advanced atherosclerosis.

Cholesterol is found only in foods of animal origin. Foods high in cholesterol are egg yolks, liver, organ meats, shellfish, lard from animals, and butter. Foods that contain no cholesterol or are low in cholesterol include egg whites, fruits, vegetables, and grains and grain products. One of the major factors in blood cholesterol levels is the dietary intake of fats — particularly saturated fats.

Fats are semisolid, energy-filled organic compounds found in animal and plant tissues. The major form of fat in the body and in foods is known as triglycerides. Triglycerides are chemical compounds that contain carbon, hydrogen, and oxygen. Fats are classified as saturated, monounsaturated, or polyunsaturated. Saturated fats have the most hydrogen. Saturated fats are found in butter, chocolate, egg yolks, lard, and many other foods. Monounsaturated fats have less hydrogen than saturated fats, and polyunsaturated fats have the least amount of hydrogen. Some examples of monounsaturated fats include some cooking oils, olive oil, some peanut butter, and some salad dressings. Polyunsaturated fats are found in such foods as Brazil nuts, some cooking oils, peanut butter, soft margarine, and walnuts. The more saturated the fat, the more solid it is at room temperature.

As research concerning the relationship of diet and coronary heart disease continues, people must stay informed of the latest findings and, in the meantime, take a rational approach to modifying their diet. The recommendations from health professionals are that persons who do not suffer from any particular health problem should still choose a healthful diet by eating a variety of foods in moderate amounts that supply their daily nutrient requirements. This practice will promote a lifetime of healthy eating.

Reducing Sugar in the Diet

The average American consumes an estimated sixty to eighty pounds of sugar a year. That is approximately one-fourth pound of sugar per day. One reason for this high intake of sugar could be the amount of hidden sugar found in convenience food items not normally thought of as sweets.



Carbohydrates are nutrients that supply energy for body functions. The other energy sources are proteins and fats. Carbohydrates are broken down in the body into sugars, starches, and fiber. The sugars are known as simple carbohydrates and the starches and fibers are known as complex carbohydrates. Fiber is used to aid the digestion of food. Sugars and starches are broken down in the body into simple sugar glucose. Glucose is the major sugar found in the bloodstream and supplies energy for the body. Some body tissues, such as red blood cells and parts of the brain, are able to get energy only from glucose.

Several carbohydrates are broken down into glucose during digestion. These terms are often used on food labels in place of the word sugar. Figure 6.3 lists the terms.

Food labels also may have other terms for sugar. Some of the other terms for sugars that are used on food labels include the following:

- brown sugar
- confectioner's sugar
- corn sweeteners
- syrup

Sugar Terms Used on Food Labels	
sucrose	— white refined table sugar, brown sugar, confectioner's sugar
fructose	— the most concentrated sweetener (found in fruits); small amounts provide the same sweetening as larger amounts of other sugars
maltose	— malt sugar; found in breads and cereals
lactose	— milk sugar; found in breads and cereals
glucose	— honey, corn syrup

Figure 6.3

- dextrose
- granulated sugar
- high-fructose corn sweeteners
- honey
- invert sugar (glucose and fructose)
- maple sugar
- molasses
- natural sweetener
- raw sugar

The Dietary Guidelines for Americans suggest that people increase their intake of complex carbohydrates and decrease their intake of simple carbohydrates. Currently, it is estimated that the typical American consumes 25 percent of calories from simple sugar and 25 percent from complex carbohydrates. It is recommended that people reduce their sugar intake to only 10 percent of total calories and increase their complex carbohydrate intake to 40-50 percent of all calories. Diets low in pure sugar and high in complex carbohydrates are generally lower in fat and calories and higher in fiber than diets that contain a large percentage of pure or refined sugars.

All forms of sugars, as well as all digestible carbohydrates, have four calories per gram. High-sugar foods have often been linked to health problems such as diabetes,

obesity, heart disease, and tooth decay. **Diabetes** is a genetic disorder and is not caused by eating too much sugar. Diabetes occurs in an individual whose pancreas does not produce enough insulin to control blood sugar levels. Diabetics must control their intake of carbohydrates in order to maintain normal blood sugar levels.

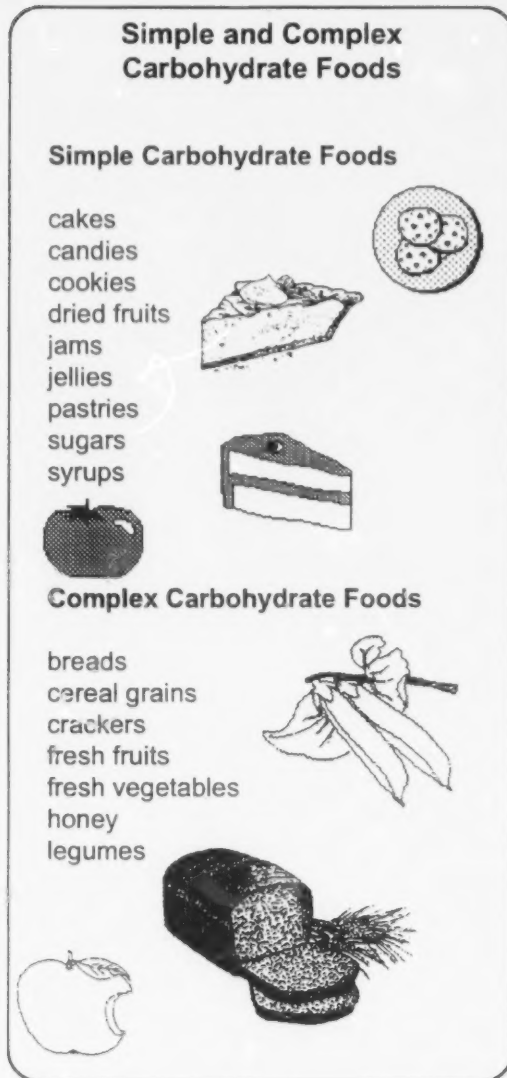
People with diabetes must balance their food intake with activity so their blood glucose levels stay in normal range. Some diabetics take insulin injections or diabetes medication to prevent severe health problems. Meal planning for diabetes control centers on "exchanges." Exchanges are foods with similar nutrient contents grouped on a list that the diabetic can select to plan meals. Dietitians and doctors work together to plan diets for diabetics individually, using the principles of variety, moderation, balance, and good nutrition.

The relationship to heart disease occurs because persons with high-sugar diets are often overweight. Obesity is a risk factor for heart disease. Too much sugar in the diet is a factor for tooth decay. Sugary foods create a perfect climate in the mouth for the growth of the bacteria that destroys tooth enamel and causes tooth decay.

Figure 6.4 lists foods that contain simple carbohydrates and those that are classified as complex carbohydrate foods. Foods from the complex carbohydrate list should be chosen as sources of energy and for their valuable vitamins and minerals.

Consumers must learn to identify sugar in their diets. Strategies for reducing the amount of sugar in the diet include the following:

- Select pure fruit juices rather than soft drinks or imitation fruit drinks.
- Choose unsweetened cereals rather than the presweetened varieties. Learn to read the labels for sugar content.
- Eat fruits canned in natural juices rather than in heavy syrups.



⇒ **Figure 6.4**

- Reduce intake of "empty calorie" foods. Empty calorie foods contain calories but no nutritional value, such as soft drinks.
- Select fresh fruits for snacks. The sugar content of dried fruits is much higher.
- Try using the sweet spices—allspice, cardamom, cinnamon, cloves, coriander, ginger, and nutmeg—to replace some of the sugar in recipes.

Achieving A Low-fat Diet

Many Americans are selecting low-fat diets in an attempt to reduce their risk of coronary heart disease and cancer. Fats are lipids that are in a solid state at room temperature. Oils are lipids that are in a liquid state at room temperature. Lipid is the scientific term that includes all of the fats, fat-related substances, and oils. Fat is one of the essential nutrients and performs several functions in the body. Fats are a source of the essential fatty acids. Linoleic acid is one of the essential fatty acids and is found in polyunsaturated fat substances. It is important for clotting blood and lowering blood pressure. Linoleic acid is the only fatty acid that the body does not make. It must be consumed in plant foods such as corn, safflower, or soybean oils. Fats are also needed to transport the fat-soluble vitamins A, D, E, and K throughout the body. Without the presence of fat, these vitamins would not be utilized.

Fats also serve as an energy source. At nine calories per gram, fats supply twice as much energy as carbohydrates and proteins. It is not necessary to consume a fat-rich diet because the body makes fat from excess carbohydrates and proteins not used for energy. However, diets containing excessive amounts of fat can lead to health risks.

Health professionals believe that the average American diet contains too much fat. Although there is no RDA for fat, it is recommended that fat intake be limited to 30 percent of the daily diet. Figure 6.5 gives the formula for figuring the percent of fat in the diet.

Some commonly eaten foods may have a higher fat content than many consumers realize. For example, amounts of fat in common foods include the following:

- Hamburger—approximately 35 grams
- Club sandwich—approximately 30 grams
- Fried onion rings—approximately 25 grams
- Beef burrito—approximately 21 grams

Figuring the Percent of Fat in the Diet

$$\frac{\begin{array}{l} \text{Number of grams of fat} \\ \times 9 \text{ calories per gram} \\ \hline \text{Total number of calories from fat} \end{array}}{\text{Total number of calories from fat}}$$

Total number of calories from fat	÷	Total number of calories daily	=	Percent of calories from fat
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Example: An adolescent who eats 2,000 calories per day could figure the percent of his or her diet that was from fat if 80 grams of fat was consumed.

$$\frac{\begin{array}{l} 80 \text{ grams of fat} \\ \times 9 \text{ calories per gram} \\ \hline 720 \text{ calories from fat} \end{array}}{720 \text{ calories from fat}}$$

720 calories from fat	÷	2,000 calories per day	=	36% calories from fat
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Figure 6.5

These are approximate amounts. The exact fat content would vary depending on the serving size and method of preparation.

High-fat diets lead to elevated blood cholesterol levels. People with abnormally high blood cholesterol levels are in a high-risk group for advanced atherosclerosis. In order to maintain a normal blood cholesterol level, people should reduce their intake of saturated fats. In order to achieve a low-fat diet, it is important to follow a few simple guidelines:

- Read labels to learn the fat content of foods.
- Choose to bake, broil, braise, or steam foods; eliminate frying.
- Refrigerate soups and stews before serving. Skim off hardened fat.
- Reduce intake of high-fat desserts.
- Reduce consumption of bacon, sausage, and luncheon meats.

- Use herbs, spices, and lemon juice to season and flavor foods.
- Choose canned fish products packed in water.
- Try using low-fat, low-calorie salad dressings.
- Use nonstick sprays in frying pans before sautéing.
- Choose low-fat or fat-free menu items and snack foods.
- Skin poultry and trim visible fat from lean meats.
- Use vegetable protein sources such as lentils, dried beans, and peas.
- Use low-fat and nonfat dairy products.
- Reduce consumption of foods high in saturated fat.
- Choose polyunsaturated fats when possible.
- Reduce total dietary fat intake.

It is helpful to know which foods contain saturated fats and which foods contain polyunsaturated fats. Figure 6.6 lists foods high in saturated fats and foods high in polyunsaturated fats. Remember that saturated fats are those that have the most hydrogen. Polyunsaturated fats have the least amount of hydrogen.

Essential Questions: Diseases and Health Problems Linked to Nutrition

1. What are some tips to lower fat and cholesterol in the diet?
2. How is the diet related to atherosclerosis?
3. How is resistance to disease related to nutrition?
4. What is the relationship between cancer and diet shown by research?
5. What is the difference between simple and complex carbohydrates?

Foods High in Saturated Fat

- Beef, pork, or lamb
- Butter and lard
- Tropical oils (coconut, palm, and palm kernel)
- Sour cream, ice cream, whole milk products
- High-fat cheeses
- Bacon, some luncheon meats
- Cakes, pastries

**Foods High in Polyunsaturated Fat**

- Vegetable oils—corn, safflower, soybean, cottonseed, sunflower
- Nuts—peanuts, pecans, cashews, walnuts
- Soft margarines and spreads



— Figure 6.6

SODIUM AND HYPERTENSION

Sodium and potassium are minerals that function in the body as electrolytes. Electrolytes affect the way fluid is distributed in the body and aid the nervous system in transmitting nerve impulses that control muscle action. This is very important in keeping the heart beating normally. Sodium also helps the kidneys to maintain a normal acid/alkali balance in the body.

There is no minimum daily requirement or RDA for sodium because the American diet shows no evidence of shortage of this

mineral. In fact, the opposite is more likely true. A large portion of the population has elevated sodium levels. Excessive consumption of sodium can result in hypertension.

Hypertension, or high blood pressure, means that the heart must work much harder to pump the blood. High blood pressure can be hereditary, a result of obesity, or a result of too much salt in the diet.

Due to the increased incidence of hypertension in adults, health professionals recommend that persons without health problems limit their sodium intake to two grams per day. This would amount to approximately 2,000 milligrams per day. Table 6.1 lists commonly eaten foods that are high in sodium.

OBESITY

The degree to which a person exceeds the healthy weight for his or her height and body build identifies weight problems. A person who exceeds the healthy weight by 10 percent has a condition called overweight. **Obesity** is defined as men having over 25 percent body fat and women having over 30 percent body fat. Target percentages of body fat are 15-18 percent for men and 20-25 percent for women. Many health risks can develop in obese people. Hypertension (abnormally high blood pressure), diabetes, heart disease, cancer and other diseases are more common among obese people. Too much weight puts a strain on the bones, muscles, heart, and other organs. Records of life insurance companies show obese people die at an earlier age and have a higher risk of chronic diseases.

Most people are overweight or obese because they eat more food (nutrient lacking) than their bodies need and they fail to get enough exercise. Developing lifelong habits of healthy eating and exercise are ways to prevent obesity and its complications.

Foods High in Sodium		
Food	Amount	Sodium Content (mg)
Crackers, saltine	5	195
Salad dressing, Ranch	1/4 c.	440
Bacon	3 slices	303
Catsup	2 Tbsp.	460
Worcestershire sauce	1 Tbsp.	600
Cheese, processed	1 oz.	450
Frankfurter (beef and pork)	1	560
Peanuts, salted	1 c.	626
Pizza, cheese	1 slice	699
Luncheon meat	2 pieces	810
Cottage cheese, small curd	1 c.	850
Soup, canned tomato	1 c.	872
Pickles, dill	5 slices	460
Olives, green	10	936
Burrito, bean	1	1030
Cheeseburger	4 oz. patty	1224
Corn dog	1	1252
Enchilada	1	1332
Chicken sandwich	1	1423
Smoked Salmon	3 oz.	1700
Salt	1 tsp.	2132

Source: "Nutritive Value of Foods," Home and Garden Bulletin No. 72, United States Department of Agriculture.

Table 6.1

◆ **Essential Questions:** ◆
Hypertension and Obesity

1. What are electrolytes and what is their function in the body?
2. How are sodium and hypertension related?
3. Why is obesity a threat to good health?

FOOD ALLERGIES AND FOOD INTOLERANCES

A food allergy is an abnormal response to the immune system to otherwise harmless foods, such as peanuts, nuts, milk, eggs, soy, fish, shellfish, and wheat. Symptoms can include hives, vomiting, diarrhea, and respiratory distress. In some cases, one bite of food can bring on **anaphylaxis**, a severe reaction that involves various areas of the body simultaneously. In extreme cases, it can be fatal.

The only way to manage food allergies is to strictly avoid the foods to which someone is allergic. Individuals with food allergies

should learn how to interpret ingredients on food labels and how to spot high-risk food.

Food intolerances are physical reactions to a food often resulting from faulty metabolism. The body cannot adequately digest a certain component of a particular food. Elements of a food's natural chemistry may cause reactions. Common intolerance's are lactose (milk sugar), gluten (protein substance in grains), and sulfites (preservatives that prevent browning and slow growth of bacteria).

Milk Allergies, Lactose Intolerance, and Milk Intolerance

Many people cannot drink milk or consume milk products because of milk allergy, lactose intolerance, or milk intolerance. Milk allergy is caused by an allergy to the protein in raw milk. Milk allergy occurs when a person has a reaction after drinking raw milk. Usually these people can consume milk in other forms or can drink boiled milk. Boiling milk denatures the protein and therefore prevents the allergic reaction. People with milk allergy can usually successfully consume milk cooked into foods or other calcium sources. Most cases of milk allergy occur in children.

One of the most prevalent of milk induced illness in children and adults is lactose intolerance. **Lactose intolerance** is the body's inability to digest the milk sugar known as lactose. The enzyme lactase aids the body in digesting lactose. Lactase is the digestive enzyme that breaks down lactose so that it may be digested and absorbed. When the body does not produce lactase, the lactose cannot be digested and illness occurs. Persons suffering from lactose intolerance must select other calcium-rich foods in order to meet their daily nutrient requirement for calcium. The addition of the enzyme lactase to milk can help people with lactose intolerance. The enzyme lactase can be purchased in

a form that can be added to the milk, or enzyme-treated milk can be purchased in the supermarket dairy case.

Milk intolerance is a condition or illness following consumption of milk or milk products. The cause of milk intolerance is not known, except that it is not due to milk allergy or lactose intolerance. Most people who suffer from milk intolerance must experiment with various foods to determine which they can eat.

Calcium is one of the most important nutrients. It is one of the major minerals and is stored in the bones. It is essential for bone growth and the prevention of bone loss in adulthood. Calcium is also necessary for the transmission of nerve impulses and muscle performance, such as the heartbeat. For many years, people believed that only children needed to drink milk while the body was building bones and muscles. However, research has shown that it is just as important for adults to consume calcium-rich foods in order to prevent bone loss. A condition known as **osteoporosis** occurs when there has been a calcium deficiency and bone loss over a period of years. Osteoporosis causes weak, brittle bones and a deterioration of the skeleton.

As a result, a lack of calcium, posture may become stooped and bones can break easily. Osteoporosis afflicts up to twenty million people in the United States. Among older women, hip fractures and complications caused by osteoporosis make it a leading cause of crippling and death. It is estimated that 25 percent of women over the age of sixty-five have osteoporosis. Women have less bone mass than men and are at greatest risk of developing this disease. Doctors cannot correct osteoporosis. However, consuming the RDA for calcium and vitamin D combined with weight bearing activity (such as walking or jogging) are the best ways to pre-

vent this bone condition. Smoking, alcohol abuse, and excess caffeine can contribute to osteoporosis.

Physicians and dietitians may recommend substitute food items to replace the calcium-rich milk and milk products in the diet. It is important to choose nutrient dense items as substitutes because milk and milk products supply an abundance of other essential nutrients besides calcium. People with these problems must experiment with different foods to find those that can be tolerated. The following are some alternative foods to substitute for the milk products in the diet:

- boiled milk
- calcium-fortified soy milk
- cheese
- cottage cheese
- enzyme-treated milk (milk with the enzyme lactase)
- goat's milk
- imitation milk (not considered suitable for infants and children)
- supplements
- yogurt

As a last resort, a physician may have to prescribe calcium supplements for a patient. Calcium is not absorbed as well from a pill as it is from food. Also, pill supplements do not offer the variety of nutrients that are available from milk and other milk products. Inclusion of many calcium-rich foods can be helpful. Table 6.2 shows some commonly eaten calcium-rich foods.

◆ **Essential Questions:** ◆
Food Allergies and Food Intolerances

1. What steps could be taken to menu planning to avoid osteoporosis?
2. How do food allergies affect the body?
3. What is the most prevalent milk induced illness in children and adults?

EATING DISORDERS

Eating disorders are diseases characterized by a preoccupation with weight loss and thinness. These disorders can have damaging effects on the physical and mental health of the persons plagued by them. Many times, this obsession with thinness causes the person to resort to excessive exercise in combination with starvation. This can result in serious bodily injury because the body has not been supplied with the energy and nutrients needed. Eating disorders can result in malnutrition, life-threatening illness, or even death. Physicians do not know what causes eating disorders; however, personal stress can trigger episodes. Disorders most often occur in women and teenage girls. The two most common eating disorders are anorexia nervosa and bulimia nervosa.

Anorexia Nervosa

In an affluent society where food is plentiful, an illness known as anorexia nervosa affects almost one out of every one hundred young women. Prior to 1950, this disease was almost unheard of, but in affluent developed nations, anorexia nervosa has almost become an epidemic. **Anorexia nervosa** is an eating disorder characterized by an obsessive and compelling desire to be thin. Out of every twenty young people with this disorder, nineteen of them are female. This disorder resembles an addiction because the person becomes totally obsessed with weight loss and a lifestyle of self-prescribed starvation takes over. This self-imposed starvation slowly begins to affect the person's personality and ability to think rationally. Many times this obsession with thinness causes the person to resort to excessive exercise in combination with starvation. This can result in serious bodily injury because the body is not been supplied with the energy and nutrients needed. Physical symptoms of anorexia nervosa are shown in Figure 6.7. One of the symptoms of anorexia nervosa is anemia.

Foods Rich in Calcium

Food	Amount	Calcium Content (mg.)
Sardines, canned w/bones	3 oz.	371
Goat's milk	1 c.	326
Shrimp, boiled	3.5 oz.	320
Nonfat yogurt	1 c.	302
Low-fat milk 2%	1 c.	297
Nonfat dry milk, reconstituted	1 c.	275
Swiss cheese	1 oz.	272
Spinach, cooked	1 c.	244
Cheddar cheese	1 oz.	204
Oysters, Pacific raw	1 c.	202
Turnip greens, cooked	1 c.	198
Broccoli, cooked	1 c.	178
Salmon, canned w/bones	3 oz.	167
Tofu	4 oz.	108
Almonds	1 oz.	75
Kidney beans	1 c.	74
Green beans, cooked	1 c.	58
Cantaloupe	1/2	29

Source: "Nutritive Value of Foods." Home and Garden Bulletin No. 72, United States Department of Agriculture.

➡ **Table 6.2**

Anemia is a condition in which the blood cannot transport oxygen to the cells in the body. This is caused by a shortage of red blood cells or the presence of abnormal red blood cells. Anemia is often a result of nutritional deficiencies and other diseases.

The treatment for anorexia nervosa is threefold. First, it involves medical personnel in the diagnosis and treatment of the medical complications that arise from prolonged starvation. Second, the treatment involves psychiatric or psychological personnel in

treating the self-defeating behaviors that reinforce severe eating disorders like anorexia nervosa and bulimia. Third, a dietitian provides nutrition counseling for the patient to help with weight gain and the return to normal eating patterns.

Bulimia

Bulimia is another eating disorder that has plagued society since it was first recognized as a medical disorder in 1980. It is similar to anorexia in that it seems to strike mostly young women who have an obsession

Physical Symptoms of Anorexia Nervosa

- Deterioration of the body; especially muscle tissue
- Menstruation stops in females; impotency occurs in males
- Skin assumes dry, yellowish tint
- Low blood pressure
- Heart function becomes inefficient due to the effect of starvation on hormones that regulate blood pressure
- Excessive hair growth on the body (possible for warmth)
- Touching causes painful sensations
- Anemia
- Interrupted sleep patterns; bad dreams

⇒ Figure 6.7

with an unrealistic perfect body. Some characteristics of people with bulimia include the following:

- They participate in binge eating followed by purging. Purging is an attempt to remove food from the body either by self-induced vomiting or the continual use of laxatives.
- They are successful and desire perfection.
- They turn to food in a crisis.
- They have a history of dieting and weight gain during the teen years.
- They binge and purge secretly.

Bulimia is an eating disorder characterized by self-induced vomiting following binge eating. Binge eating is the overindulgence of food without control or rational judgment about the amount being consumed. Sometimes a person with bulimia uses laxatives to rid his or her body of what is thought to be harmful. These binge eating periods are not in response to hunger, but rather a compelling need by the person with bulimia to rid his or her body of food that might cause

weight gain. Bulimic behavior is sometimes brought on by family stress or feelings of rejection. Characteristics of a person with bulimia are low self-esteem, social anxiety, depression, isolation, and difficulty with interpersonal relationships. Figure 6.8 lists the dangerous effects of bulimia.

Damaging Effects of Bulimia

- Irritation of the esophagus
- Abnormal heart rhythms
- Injury to the kidneys
- Bladder and kidney infections, possibly causing kidney failure
- Lacerations or tears to the stomach, caused by excessive vomiting
- Tooth decay
- Malnutrition

⇒ Figure 6.8

The treatment for bulimia is similar to that of anorexia nervosa because it involves the assistance of medical, psychological, and dietetic personnel. Through nutrition counseling, psychotherapy, and medical therapy, the bulimic patient can regain a new sense of self-worth and learn ways to control the need for binge eating. However, our society must change its attitude toward the unrealistic images of perfect people with perfect bodies that are expressed through the media. It is imperative that positive messages of respect and value for each individual's unique qualities and talents replace those negative messages currently seen by young people. Ideally, this type of societal change would greatly reduce the number of victims of anorexia nervosa and bulimia.



◆ **Essential Questions:** ◆
Eating Disorders

1. What is anorexia nervosa? How is it treated?
2. How can society work to reduce the incidence of anorexia and bulimia?
3. What are the three phases of treatment for bulimia and anorexia nervosa?

THERAPEUTIC DIETS

Physicians often prescribe *therapeutic diets* (special eating plans) for patients with specific health problems or diseases. Most doctors consult dietitians because of their expertise in designing menus aligned with the person's preferences as well as with the special dietary needs. Advances in medical science have shown an increased relationship between diet, disease, and recovery.

Examples of specific health problems which require a special diet are diabetes, heart disease, cancer, and various food allergies. See Table 6.3 for examples of therapeutic diets.



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Therapeutic Diets			
Diet	Description	Uses	Examples of Foods Allowed
Liquid	Less irritating than solid food; fed six or more times during hours patient is awake.	Acutely ill patient; patient who has difficulty chewing or swallowing.	Depends on whether clear-liquid or full-liquid diet is prescribed.
Clear-liquid	Consists of liquids which are clear in color. Supplies very few nutrients but does give the body necessary fluids. Usually given for only one or two days.	Used when patient cannot eat food or when there is nausea or vomiting.	Gelatin, broths, tea, some carbonated beverages, apple juice.
Full-liquid	All-liquid diet which meets all the nutritional needs of patient. Can be used longer length of time than clear-liquid diet. Cream may be added to milk and milk drinks to increase caloric value and to help reduce hunger pangs. Corn syrup or lactose (milk sugar) can be used to add calories.	Follows clear-liquid diet as patient improves.	Milk, eggnog, citrus and other juices, broth, coffee, tea, carbonated beverages, gelatin, sherbet (no pulp), cereal gruel, strained vegetable juices.
Soft	Nutritionally adequate diet consisting of soft-textured foods or foods which have been changed or strained and are easily digested. Raw fruits and vegetables are not permitted. Tough meats should be avoided. Coffee and tea are usually limited.	Generally follows the liquid diet. Used for patients with serious infection, patients recovering from surgery, one having a disorder of the digestive system, or one who is too weak to make an effort to chew.	Milk, soft eggs (not fried), tender or chopped meats (not fried or highly seasoned), potatoes, and selected cooked vegetables, some cooked and canned fruits, toasted white bread, crackers, cooked cereals (no hot breads).
Bland	Diet compound of mild-flavored foods which are not especially sweet, sour, sharp, bitter, or strong. Foods with coarse fibers should be avoided, as well as fried foods and strong flavored vegetables, such as onions, dried beans, cabbage, and cauliflower. Caffeinated beverages should be limited or omitted because of their stimulating effects.	Sometimes given after full-liquid diets or for patients with internal open lesions that are in the process of healing.	Applesauce, ripe bananas, creamed soups, vanilla ice cream, sugar cookies, cooked pears, cottage cheese, plain gelatins, plain cake, plain custards and puddings, milk, macaroni, potatoes, soft eggs, rice, bread, cereal products such as farina and cream of wheat, and baked or broiled meats, fish, and poultry.
Diabetic	Modified normal diet specifying exact amounts of protein, fat, and carbohydrate needed by patient.	Used to restrict amounts and types of certain foods to help control diabetes. Also used in weight reduction diets and for diets of some cardiovascular (heart) patients.	Uses exchange list composed of six food groups. Foods in each group have comparable food values. One food may be substituted for another in the same group. Examples: An exchange for 1 slice of bread is 1/2 c. cooked cereal or 1/2 c. mashed potatoes. Those recommended by American Diabetes and American Dietetic Association.
Calorie-restricted	Limited calorie content, but nutritionally adequate.	Used for weight reduction.	Often utilizes exchange system.
Calorie-controlled	Adjusts calorie intake to maintain weight loss.	Used to maintain weight without gaining or losing.	Utilizes exchange list.
Fat-restricted	Nutritionally adequate but may be low in calories due to fat restriction. May be supplemented by additional amounts of protein and carbohydrate. May cause loss of appetite.	Used for patients with liver, gall bladder, and certain cardiovascular diseases.	Foods low in fat. Those recommended by the American Heart Association.
Sodium-restricted	Nutritionally adequate diet with limited amounts of salt and foods high in sodium content. May result in loss of appetite.	Used when there is edema (sodium retention) related to heart conditions, toxemia of pregnancy, and other swelling conditions.	Avoid bacon, ham, corned beef, olives, sauerkraut, sausage, potato chips, salty crackers, pretzels, saltwater fish, and shellfish.

Table 6.3



Chapter Highlights

- ☆ Wellness can be defined as the state of being in good health. When people are in good health they have energy and a positive outlook on life.
- ☆ Preventive nutrition is the process of maintaining good health and wellness through good nutrition practices before illness occurs.
- ☆ Experts have developed a number of tools to help people evaluate their diets and make wise food choices.
- ☆ Advances in medical science have shown an increasing relationship between the food consumed and good health. Doctors and dietitians also know the many ways diet is related to disease and recovery.
- ☆ The risk of developing cancer may be greatly reduced in persons who make wise food choices and reduce or eliminate alcohol and tobacco consumption.
- ☆ Cholesterol is found only in foods of animal origin. Foods high in cholesterol are egg yolks, liver, organ meats, shellfish, lard from animals, and butter.
- ☆ Even though cholesterol is found in every cell in the body and is necessary for its function, it is also the main part of the plaques that block the arteries in atherosclerosis.
- ☆ Diabetes is a genetic disorder and is not caused by eating too much sugar. Diabetes occurs in an individual whose pancreas does not produce enough insulin to control blood sugar levels.
- ☆ Excessive consumption of sodium can result in hypertension. Hypertension, or high blood pressure, means that the heart must work much harder to pump the blood. High blood pressure can be hereditary, a result of obesity, or a result of too much salt in the diet.
- ☆ Anorexia nervosa and bulimia are serious eating disorders that require medical, psychological, and nutritional counseling and treatment.
- ☆ High-sugar foods have been linked to health problems such as diabetes, obesity, heart disease and tooth decay.
- ☆ Although there is no RDA for fat, it is recommended that fat intake be limited to 30 percent of the daily diet. High-fat diets lead to elevated blood cholesterol levels.
- ☆ Calcium is essential for bone growth and the prevention of osteoporosis in adulthood. Calcium is also necessary for the transmission of nerve impulses and muscle performance, such as the heartbeat.

Chapter 7

Quality Nutrition



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 2A Determine various methods for retaining nutrients and improving nutrient content in foods.
- 2B Describe the impact of new technology on food science.
- 7A Summarize new research and trends in technology



Chapter Vocabulary

artificial	leaching
aspartame	meat analogues
degradation	olestra
enriched	oxidation
food fabrication	palatable
formulated foods	perishable foods
fortified	pH Level
functional foods	synthetic
genetic engineering	
hydroponic farming	

While learning which nutritious foods to choose at the supermarket, it is important to learn how to store and prepare those foods so that most of the nutrients are retained. Several factors should be considered when storing and preparing foods to promote nutrient retention and to prevent nutrient loss.

NUTRIENT LOSS IN FOOD

Many people assume they are getting all the nutritional value of a food just by eating it. What they do not stop to consider is that quality, storage, and preparation techniques

all influence the amount of nutrients that are retained in food.

Oxidation

Fruits and vegetables are most susceptible to nutrient loss because of their perishability. **Perishable foods** are those that deteriorate and spoil quickly. The quality of most fruits and vegetables is best when the produce is allowed to ripen on the vine, chilled immediately, and kept chilled until ready for use. However, vine-ripened products are more difficult to distribute because of their extreme perishability. Vegetables such as potatoes, yams, and onions are best if stored in a cool, dry, dark place. As soon as a fruit or vegetable is harvested, degradation begins.

Degradation is the term that describes the loss of quality that occurs after fruits and vegetables are harvested. Chilling soon after harvesting helps slow the degradation process. Vitamins A (retinol) and C (ascorbic acid) are most stable when protected from the oxygen in the air. Antioxidants are substances that prevent oxidation from taking place. **Oxidation** is a chemical change that occurs in foods as they age. The enzymes in the food may be activated by oxygen in the air and thus cause a loss of vitamins. When the oxygen is removed, the destructive effects of oxidation are greatly reduced. Once a fruit or vegetable is cut or a can is opened, it should be stored in an airtight container or wrapper and should be refrigerated.

Enzymes

The freezing of foods requires some precaution to ensure that valuable nutrients are not lost. Fresh vegetables should be blanched before freezing. Blanching is a method of deactivating enzymes by immersing the vegetables in boiling water or exposing them to steam for a few minutes, then cooling the vegetables before freezing. Blanching destroys the enzymes in the food that would break down the nutrients. Once the food has cooled,

it should be frozen immediately in airtight containers or freezer bags. Many fruits do not need any special preparation prior to freezing. Sugar helps to prevent the action of the enzymes, so fruits frozen with sugar may retain more texture and flavor than those frozen without sugar. Meats should be wrapped airtight before freezing and the freezer temperature should be kept at 0° F.

Leaching

Much care must be taken to ensure that water-soluble vitamins and minerals are protected. **Leaching** is a term that refers to the loss of vitamins and minerals into water. Vitamin C, B vitamins, and some minerals are soluble in water. These vitamins are dissolved in the water in which fruits and vegetables are cooked or canned. Many people do not realize that when they discard the water the food has been cooked in, nearly half of the vitamins are poured down the drain. To prevent this loss of nutrients, fruits and vegetables can be steamed over water or boiled in a small amount of water so that the water can be reabsorbed into the food by the end of the cooking time. Nutrients also are retained if the water is used for soups or sauces. Fruits and vegetables should be washed before being cut to prevent nutrient loss during washing. The liquid from canned fruits and vegetables should not be discarded because it contains nutrients that have been leached into the liquid. The vegetable should be cooked in the liquid, and the liquid should be saved for use in soups, to cook rice, or to add to casseroles. More nutrients also will be retained if lengthy cooking times and high heat are avoided during preparation.

Light

Light speeds the oxidation process that causes loss of nutrients in some foods. Vitamins B₆ (pyridoxine), C, and riboflavin are most sensitive to light. Some nutrient loss can be prevented by packaging and storing food in opaque containers. Opaque is the opposite

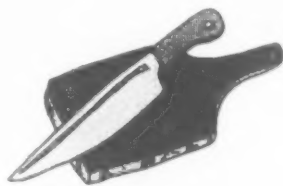
of transparent. Opaque containers do not let light pass through them. Also, limited exposure of cut surfaces to light helps in nutrient retention. Milk is packaged in opaque containers to lessen the loss of valuable riboflavin.

Heat

Heat is a factor in nutrient retention because it speeds the loss of nutrients. However, heat also is required to destroy the harmful microorganisms in food that cause food-borne illness. The oxidation process is accelerated by heat and slowed by cold temperatures. Vitamins that are sensitive to heat include vitamins A, B₆, C, and thiamin. Minerals are not affected by heat. Along with the high temperature of heat, there is greater nutrient loss the longer the food is exposed to the heat. Thus, the overcooking of fruits and vegetables should be avoided to aid in nutrient retention.

Manipulation

Manipulative procedures such as chopping and peeling cause nutrient loss in fruits and vegetables. Manipulative procedures involve actions that are done to food to change it from its original state. Some examples of manipulative procedures are chopping, grating, peeling, and slicing. Many nutrients are found close to the peelings of fruits and vegetables. Peeling, chopping, grating, and shredding vegetables and fruits cause a considerable loss of vitamin C. Thus, fruits and vegetables should be cut in large pieces and should be left in the skins when possible.



Alkalinity and Acidity

The nutrient content of foods can be affected by the alkalinity or acidity (pH level) of the food. The **pH level** refers to the acidity or alkalinity of the food. The pH values range from 0 to 14 with 7 representing neutrality. Values below 7 indicate increasing acidity, and values above 7 indicate increasing alkalinity. Alkaline is a water-soluble substance that neutralizes acid. Alkalies have a pH of 7 to 14. Acids are chemical compounds that have a pH level of 0 to 7 and have a sour taste. Acids react with a base to form salt. Acid solutions can destroy vitamin A, vitamin D (calciferol), and folacin. Alkalies can cause riboflavin, thiamin, and vitamins C and D to be destroyed in food.



In the past, many people have added a small amount of baking soda (an alkaline) to the water when cooking green vegetables. Although the baking soda does improve the color of the cooked vegetables, the nutrients that are sensitive to alkaline are lost. However, some foods benefit from the addition of acid substances. The acid used in pickling helps to preserve some nutrients but can cause the loss of others. The addition of acids, such as lemon juice or cream of tartar, when cooking cauliflower not only improves the color but is also beneficial to some nutrients.

◆ Essential Questions: ◆ Nutrient Loss in Food

1. How is exposure to light a factor in nutrient loss in some foods?
2. What manipulation procedures can cause nutrient loss?

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TECHNIQUES THAT PRESERVE NUTRIENTS

Many foods in our culture are considered highly palatable when eaten in their raw form. **Palatable** refers to the acceptability of the food to the palate, or taste. Foods that appeal to a person's sense of taste, smell, and sight as well as foods with the appropriate temperature and texture are considered palatable. Fruits and vegetables are the foods most commonly eaten in raw form. This is especially important when considering the nutrients that are lost through cooking. In many instances, however, cooking improves the palatability, flavor, color, texture, and digestibility of food. Cooking also destroys organisms and bacteria that could cause food-borne illness.

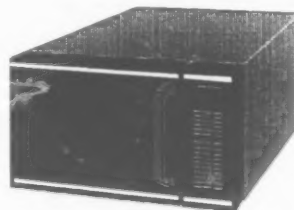
Consumers can take precautions to preserve the nutrients in the foods they prepare by following some food preparation practices. Microwave cooking, steaming, and stir-frying are methods that improve nutrient retention in foods. Simmering foods in a small amount of liquid for a minimal amount of time also helps to improve nutrient retention. Figure 7.1 lists some additional suggestions for preserving the nutrient content of foods prepared at home.

It is important to understand how nutrients are lost so that methods to improve nutrient retention can be used. Knowledge of principles of food preparation and storage can greatly improve the nutritional value of the foods that are cooked. Vitamins are the most easily lost of all the nutrients, so the greatest care must be taken with vitamin-rich foods. Some minerals are lost in leaching and manipulative procedures, but they are not destroyed by heat or oxidation. The nutritional value of carbohydrates, proteins, and saturated fats is not negatively affected by normal food preparation procedures.

New Technology and Nutrient Retention

New technology and trends in food processing and preparation have concentrated on methods to help improve nutrient retention. Microwave cooking, stir-frying, quick-freezing, dehydration, and freeze-drying are new trends in preparation and preservation methods that allow for the optimum retention of nutrients.

Microwave Cooking. Microwave cooking is the cooking of food in a microwave oven which uses electromagnetic energy to create heat. Research on the nutrient retention of foods cooked in the microwave oven shows that the foods retain as many, if not more, nutrients than foods prepared by more conventional methods. Microwave cooking tends to reduce the loss of some vitamins due to the fast, efficient method of heating. Leaching of water-soluble vitamins into the cooking water does not seem to occur with microwave cooking. Some studies have shown greater retention of folacin, thiamin, and vitamin B₆ in some foods cooked in the microwave oven.



These advantages are due to the fact that vegetables are cooked with very little or no water for a very short period of time. This limited exposure to heat improves nutrient retention. Foods prepared in the microwave oven do not require the addition of any fat for cooking; therefore, dietary fat and calorie content are reduced.

Foundations of Food Preparation reports that ground beef patties cooked in the microwave oven have less fat and fewer calories

Preserving Nutrients

- ◆ Avoid overcooking. Prolonged exposure to heat causes loss of some vitamins.
- ◆ Cover refrigerated foods with tight-fitting lids, foil, or plastic wrap.
- ◆ Cut fruits and vegetables in large pieces. Chop immediately before use to avoid unnecessary exposure to oxygen.
- ◆ Freeze or refrigerate leftovers immediately after use. Leaving foods exposed to room temperature increases nutrient loss, promotes an environment for bacteria to grow, and increases rate of spoilage.
- ◆ Include raw fruits and vegetables in menu planning and food preparation.
- ◆ Refrigerate most products to reduce nutrient loss.
- ◆ Rinse foods in cold water. Do not soak. This causes loss of valuable water-soluble nutrients.
- ◆ Thaw frozen foods in the refrigerator. More nutrients are retained at cooler temperatures, and this also inhibits the growth of organisms that can cause food-borne illness.

→Figure 7.1

after cooking than ground beef patties cooked by some other methods.

A microwave-cooked ground beef patty with a fat content of 24 percent contains approximately 134 calories after cooking. However, a ground beef patty with a fat content of 24 percent that is broiled in a conventional oven contains approximately 164 calories. These factors show that microwave cookery can be an effective method of food preparation that improves nutrient retention of some foods and reduces calories and fat.

Stir-frying. Stir-frying is a cooking method that is traditionally used in China and Japan; however, due to the nature of the stir-frying method, many Americans have adopted this popular cooking method. Stir-frying is a quick method of cooking that uses very little fat. A Chinese pan called a wok is recommended because of the wide cooking surface and sloping sides. Foods are cut into small pieces for stir-frying so they will cook fast. Stir-frying is considered a good choice for cooking because the fast cooking time improves nutrient retention. Since the

vegetables are cooked only until they are slightly tender but still crisp, the natural flavors of the foods are so evident that the addition of butter or sauces is not needed. This also reduces fat and calorie content.

Quick-freezing. Quick-freezing is a method of food preservation that uses quick-freezing techniques such as air-blast freezing and freezing by liquid nitrogen. Research and experience have shown that the faster the food is frozen, the higher the quality. These methods not only reduce flavor, color, and nutrient loss, they also lessen the amount of tissue damage. This results in a food product with better texture.

Dehydration. Dehydration is a method of food preservation whereby water is removed from the food product so that microbial growth is inhibited. Microbial growth refers to the growth of microbes. Microbes are any bacteria that cause food spoilage and disease.

Dehydration requires food preparation procedures such as washing, trimming, and

blanching. Nutrient loss can occur during these preparation procedures because the vitamins and minerals in the food are exposed to air, heat, light, and water. Dehydration can result in a significant loss of the water-soluble vitamins, especially vitamin C and thiamin. However, dehydrated or dried foods have a high mineral and fat-soluble vitamin content and also are sources of carbohydrates and proteins. Dried fruits have a high concentration of natural sugars, which results in a product with a high calorie content.

Freeze-drying. Advances in food preservation technology have introduced freeze-drying as a method of drying foods. Freeze-drying is a food preservation technique in which food is first frozen and then dried using a vacuum chamber. The foods are thus reduced in weight and bulk. Many times they retain their size, but the weight of the food is decreased. In most instances, the texture and nutrient retention in freeze-dried foods are good. Sometimes the flavor is affected, especially in fruits and vegetables. Freeze-drying improves the quality of the dried food but is more expensive than other methods of food preservation.

As a part of commercial processing, perishable foods are also preserved to prevent spoilage and shelf life. Other commercial preservation methods include the following:

Canning. Foods are sealed in airtight metal or glass containers and heated to destroy harmful microorganisms.

Drying. Moisture, needed by harmful microorganisms, is removed from food. Grains, dry beans, milk, and fruit are typically dried.

Controlled Atmosphere Storage. This method helps extend shelf life of some foods, especially fruits. The fruits are held in a very cold area where nitrogen, carbon dioxide, and oxygen in the atmosphere are controlled.

Curing. Ingredients such as salt, spices, sugar, sodium nitrate, and sodium nitrite, are added to the food. This method is used to preserve fish, pickles, vegetables, ham, bacon, and corned beef.

◆ **Essential Questions:** ◆
Techniques that Preserve Nutrients

1. What are important guidelines that aid in preserving the nutrient content of foods prepared at home?
2. How does stir-frying aid in nutrient retention?
3. Why is heat a factor in nutrient retention? Why is heat important in food preparation?
4. What are some of the commercial processing methods used to preserve nutrients?

TECHNOLOGY IN FOOD PROCESSING

Technology is the combination of techniques and tools or instruments that permit a person to accomplish a task. In food technology, the fundamentals of chemistry, biology, physics, and engineering are applied to the problems of food production, processing, and preservation. The many new food products that consumers find on the supermarket shelves are examples of advancements in food technology. Although consumers are always ready for new products that improve living standards, they are often skeptical about new food products. This skepticism is due to a lack of communication and education between food companies and consumers. Consumers need to understand some basic information about food science and technology in order to fully appreciate the

advantages that advancements in food technology have brought to modern living.

Biotechnology

Biotechnology is defined as a science that uses technology, engineering, and knowledge of biological systems to develop and improve agricultural processes such as food production. Biotechnology uses living organisms to develop a new product. Cheese and yogurt are good examples of the use of living organisms in creating new products. Cheese and yogurt are made by the use of live bacteria in the fermentation process. In research laboratories around the world, biotechnology is responsible for many new innovations in food science. Biotechnology has made possible some new products that are available today. Consumers can purchase products such as beef with less saturated fat, more calcium-rich dairy products, and disease-resistant plants.

The difference between biotechnology and procedures that have been used in the past is genetic engineering. **Genetic engineering** allows scientists and food technologists to cross species barriers to select one gene or trait in an organism and use it to develop a better, more efficient organism.

Scientists have already used genetic engineering to produce new varieties of pest-resistant potatoes, disease-resistant squash, and firmer tomatoes. These plants are easier to grow, retain more nutrients, and stay fresh longer. Genetic engineering raises issues that are debatable and must be dealt with in the interest of the consumer. The Food and Drug Administration (FDA) has developed guidelines for assessing the safety of genetically altered foods. However, others see genetic engineering as a positive force to increase diversity of the world's food supply.

Biotechnology most greatly affects the food supply through agricultural production. New advancements include development of

plants with characteristics that are disease resistant, herbicide resistant, insect tolerant, and virus resistant. These new developments are intended to increase agricultural yields and decrease the use of pesticides.

Food technologists and agricultural specialists are experimenting with changing the properties of some fruits and vegetables to create a more desirable product. For example, research includes developing a tomato that is more flavorful and solid and can vine-ripen without rotting. Another example is the improvement of the quality of corn, by manipulating one or two genes that increase the level of essential amino acids.



Another area where biotechnology is being used is waste management. Developing new ways to efficiently use food waste products is a must. For example, it takes ten pounds of milk to make one pound of cheese. The product left over after the cheese is made is known as whey. For a long time, whey was sprayed onto the soil to be broken down by the bacteria in the soil and absorbed. However, now soil is saturated and a new use for the whey must be found. The Japanese have used genetic engineering to develop a yeast from whey. They use this genetically engineered yeast to make hepatitis B vaccine. The hepatitis B vaccine protects people from the hepatitis B virus. Hepatitis B is a very serious viral liver infection. Thus, the Japanese have taken food waste and created a valuable medicine. Biotechnology is beneficial in creating new uses for food waste for the future.

Farmers are working cooperatively with scientists to produce quality foods less expensively. The concern of many people is the use of chemical fertilizers and pesticides which may contaminate the water and food supply. Sustainable farming is a type of farming that avoids using chemicals as fertilizer. Farmers use animal manure as fertilizer and "good" bugs to destroy "bad" bugs. This process is called integrated pest management.

Other methods, such as *hydroponic farming* (growing plants without soil), are becoming popular. Nutrient-enriched water provides food for the plants. Look for hydroponic lettuce, cucumbers, and tomatoes in supermarkets. Also, there is a new method of growing fish or seafood in enclosed areas of water called aquaculture. Aquaculture is one of the fastest growing industries in the world. For example shrimp farmers supply about one-fourth of the world shrimp market by using aquaculture methods of production.

Food Fabrication

Food fabrication is the formation of an imitation or fake food product that resembles real food. A good example of a fabricated food product is surimi. Surimi is an imitation seafood product made from inexpensive fishes, primarily pollock. The fish is deboned and then puréed to form a paste. Puréeing is a method of converting a food to a paste or thick liquid by forcing the food through a sieve or using a food processor. The puréed product is mixed with other ingredients, such as egg whites, starch, wheat flour, flavorings, or preservatives and is then shaped to resemble lobster, crab meat, shrimp, or scallops.

This product is very versatile because it can be shaped and frozen into any form. Although surimi was first introduced into the United States in the late seventies, the Japanese have been using it as a dietary mainstay for nine hundred years. The Food and Drug

Administration (FDA) considers surimi to be a wholesome and nutritious product. However, many consumers may be misled to believe they are eating the real shellfish because surimi is often labeled as seafood.

Aspartame is another fabricated food substance. **Aspartame** is an artificial sweetener that is marketed as NutraSweet™ when used as a food additive and as Equal™ when used as a table sugar substitute. Aspartame loses its sweetening ability when heated, so it is not satisfactory for cooking or baking. However, aspartame can withstand the mild temperatures of warm beverages. It cannot be used by people with PKU (phenylketonuria) because their bodies cannot metabolize phenylalanine, one of the amino acids in aspartame. PKU is an inherited deficiency of the enzyme that metabolizes phenylalanine in the liver. Without treatment, PKU leads to brain damage and severe mental retardation. Although there was much controversy concerning FDA approval of aspartame, it has now passed FDA approval twice and is considered safe for consumer use.

Another sugar substitute that is controversial is saccharin. It was first introduced in the early 1900s. Studies linked saccharin with cancer in laboratory animals in 1977 and it was banned. The rule changed to allow products containing saccharin to be sold if a warning appeared on the label and in the store.

The newest artificial sweetener to receive FDA approval is acesulfame-K. Acesulfame-K is a chemical compound that is combined with dextrose, cream of tartar, and flavorings to form an artificial sweetener marketed as Sunette™ or Sweet One™. This product has the advantage of retaining its sweetening capabilities in cooking and baking. Other new artificial sweeteners that have been developed are Lev-O-Cal and stevioside. Lev-O-Cal is an artificial sweetener that resembles real sugar in taste and appearance. It is calorie-free because it is not absorbed by the body.

Lev-O-Cal can be used successfully in cooking and baking because it is not broken down by heat. Stevioside is a natural sweetener that has been used in Brazil and Japan for many years. It is made from the leaves of a South American plant and is two hundred and fifty to three hundred times sweeter than sugar. Stevioside is calorie-free and can be used in place of sugar in food preparation.

Texturized vegetable protein is a protein product used to make food products that resemble meat, fish, or poultry in taste and appearance. Soybean products are most often used for this purpose because they can be made to look like many other foods. One of the most common uses of texturized vegetable protein is as a filler in meat products. An example of a product made from soybean proteins is the artificial bacon chips sold in the supermarket.

Food Production and Processing

Advances in food technology bring new products to the supermarket shelves. For many years, consumer demands included mostly convenience products that saved time and energy in preparation. The increased concern and awareness of the relationship between diet and health has changed consumer demand. The American consumer not only wants new food products that are easy to prepare yet taste like homemade, they also want food products that offer good nutrition and fewer calories. Health and weight-conscious Americans have challenged the food industry to meet their demands with new food products that fit these requirements. It is the job of food technologists to create and modify food products to meet this consumer demand.

New advancements in the field of food technology include the innovation of new fat substitutes. Since excessive fat intake has been linked to coronary heart disease, atherosclerosis, strokes, and some cancers, health

conscious consumers are searching for products that supply the satisfying taste and texture of fat in foods without the negative effects. Two fat substitutes created by food technologists include Simplese™ and Olestra.

Simplese™ is a fat substitute made from milk and egg white protein. It contains about two calories per gram compared to the nine calories per gram in normal fats. Simplese™ is made by heating and blending the protein into tiny particles that resemble the taste and texture of fat. These tiny particles create a sensation of creaminess just as fat does. Presently, Simplese™ is used in a frozen dairy product that resembles ice cream. It cannot be used in cooked products because the addition of heat causes the product to lose its creaminess.

Another fat substitute recently developed is olestra. OLEAN™ is the brand name on food labels. **Olestra** is a calorie-free fat substitute made from a combination of vegetable oils and sugar known as sucrose polyester. The olestra molecules are so large that they are not digested or absorbed in the body. In cooking, olestra performs like regular fats because it is mostly fatty acids from vegetable oils. The FDA approved olestra in 1996. However, it removes some fat-soluble nutrients from the body. Because olestra is not digested, some vitamins carried by fat are not fully absorbed. Usually, fat-soluble vitamins are added to foods made with olestra. For some people, eating foods with olestra may be linked to digestive discomfort.

Many other new food products are results of advancements made in food technology. The juice box has been acclaimed as one of the most significant food science innovations in fifty years. The reasons behind this commendation by food safety and nutrition experts are the aseptic packaging, processing technique, and convenience. Some of the other new innovations from food technology include controlled-atmosphere



packaging for fresh fruits and vegetables, freeze-drying, frozen concentrated citrus juices, frozen meals, improved understanding of water activity in

foods, nutrient fortification, and pasteurization of dairy products through ultra-high temperatures.

Salatrim is another fat-based replacer used in dairy products, baked goods, and confection-type products. As food technology develops more products, look for other reduced-fat and fat-free labels.

A new high-fiber ingredient currently being researched is fluffy cellulose. Fluffy cellulose is a derivative of citrus pulp, sugar beet pulp, and wheat straw that has the capabilities of a flour substitute. Fluffy cellulose contributes no calories because cellulose cannot be absorbed or digested by humans. This product is being tested as a substitute for part of the flour in cakes. Cakes made with fluffy cellulose are more moist and bake up larger than cakes made with 100 percent regular wheat flour. The use of fluffy cellulose reduces the calorie content of the cakes by approximately 10 to 20 percent.

Artificial refers to food products or ingredients that are imitations or substitutes for natural food items. A **fortified** food is a food to which nutrients that were never present originally have been added to improve the nutritional value of the food product. An example is milk that has been fortified with vitamin D. An **enriched** food is one to which the nutrients that have been lost in processing are added to the food in amounts equal to those originally present or in increased amounts. Examples of enriched food products include breads, cereals, and some flours.

Formulated foods are food products developed to supplement diets and feeding programs for people who are malnourished or suffering from some nutritional deficiency. One of the most well-known formulated foods was Incaparina, a mixture of corn and cottonseed flour used as part of a supplemental feeding program in Central America and Panama.

Meat analogues or meat replacements are food products made from plant proteins that have been shaped and formed to resemble meat products. Meat analogues are made of textured vegetable protein and imitate meat products in appearance, taste, and texture. Some meat analogues are made from tofu, a cakelike product made from soybeans and water. Tofu has been used as a protein source by the Japanese since it was first introduced by Buddhist monks in the twelfth century.

Meat analogues are popular food choices because they have a low fat content and are generally less expensive than their real meat counterparts.

Synthetic foods are manufactured food products that are made from artificial chemicals that resemble those naturally found in foods. All food is made up of chemical compounds. Food technologists and scientists have been able to analyze the chemicals found naturally in food and duplicate them in the laboratory. Often, the synthetic food product may be superior to the natural food because some of the toxic substances that naturally occur in food can be omitted. The human body cannot distinguish between synthetic foods and real food because the molecular structure of the synthetic ingredients correspond to those found in natural foods. An example of a synthetic product

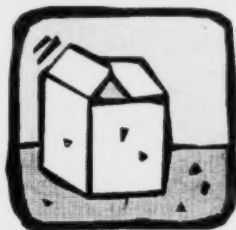


is vitamin tablets. Vitamin tablets have the exact chemical components as the vitamins that occur naturally in food.

Many synthetic foods are manufactured using plant and animal sources in nonconventional ways. For example, infant formulas are made from a variety of ingredients, such as soy milk, in an effort to duplicate breast milk. Most synthetic foods have the same nutritional value as the natural foods they imitate. Many synthetic foods are fortified during the manufacturing process to increase the nutritive value. The benefits of synthetic foods include longer shelf life, lower cost, and unlimited availability to the consumer.

Packaging

Packaging is the final step in the processing of food products. Not only does packaging protect foods from damage, it also protects foods from spoilage due to bacteria, heat, light, and oxygen. Packaging also shields foods from the damaging effects of insects and other pests.



From a marketing standpoint, eye-catching packages increase sales. Besides protecting food from damage or spoilage, many foods are packaged according to how they will be used. For example, many frozen convenience foods are packaged in boil-in-bags or plastic trays that allow for easy food preparation. These foods may be cooked right in the package. In this era of dual-career families, this type of packaging has been a successful marketing tool because of the added convenience. Other packaging techniques include resealable plastic bags and plastic or glass containers with snap-on or

screw-on lids. Figure 7.2 lists some new advancements in packaging technology.

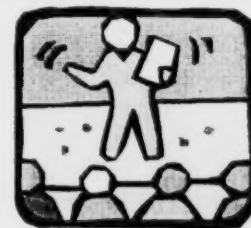
All of these new packaging technologies add cost to the price of food. It is estimated that eight cents of every American food dollar goes for packaging. Paperboard boxes and food containers represent the largest packaging cost. Approximately 20 percent of packaging costs are for plastic products.

◆ **Essential Questions:** ◆ **Technology in Food Processing**

1. How do biotechnology and genetic engineering affect the food supply?
2. What are advantages to fabricated foods?
3. What are advantages to using the new fat substitutes?

PRODUCT DEVELOPMENT

As lifestyles change and Americans become more health conscious, food choices and eating patterns change. These changes have a great effect on the food industry. Consumers are demanding food products that combine taste, texture, and appearance with convenience and nutrition. These factors produce an ongoing challenge for the food industry. Food technologists continuously work on product development. These efforts enable the American consumer to have the most abundant food selection in the world.



Packaging Technology

➤ Aseptic packaging

Foods are sterilized and then packaged in sterilized aseptic containers such as laminated paper and foil cartons, plastic bags, and plastic cups. Aseptically-packaged food can be stored without refrigeration. Aseptic packaging is sterile and prevents the growth of harmful microorganisms.

Example: fruit juice boxes

➤ Retort pouch

Food is sealed in the package before it is processed. After opening the package, only heating is required. It has an indefinite shelf life.

Example: main course entrees that require no refrigeration

➤ High-temperature Short Time (HTST) aseptically packaged milk and milk products

HTST is a pasteurization process that uses highly controlled heating of the milk for a short time. This process kills harmful microorganisms and also deactivates the enzymes that cause bitterness without affecting the flavor of the milk. Milk is packaged in sterilized (aseptic) laminated paper cartons or opaque plastic bottles.

Example: fluid milk and milk products

➤ Modified atmosphere packages for meat, fish, poultry, fruits, and vegetables

This process involves packaging these products in an atmosphere with a high concentration of carbon dioxide. The carbon dioxide retards the growth of microorganisms that causes spoilage and mold. This process greatly extends the shelf life of these foods.

Example: cooked meats and bacon

➤ Film

This includes perforated film, opaque film, or vacuum-packed and nitrogen backfill packages for luncheon meats.

⇐ Figure 7.2

The current trends in product development are food products that meet the needs of Americans who are health conscious, dieting, and busy.

New Products for the Health

Conscious Consumer

Information on health-related issues and the relationship of diet and health is available to anyone who is interested. Consumers are more knowledgeable than ever before on

topics related to diet and health. Even though some of the information consumers hear and read is not factual or based on research, the emphasis on a healthier society has increased awareness and changed public attitude toward nutrition.

The emphasis on lowering fat and cholesterol for a healthy heart has brought many new products to the supermarket shelves. Even though margarines are predominantly fat, the saturated fat and calorie content vary

greatly from product to product. New products on the market have as few as three grams of fat per tablespoon with only half a gram being saturated fat.

Consumer demand for foods with lower fat content has challenged the beef industry to develop new breeds of cattle that produce a leaner beef product. Changes in grazing practices and crossbreeding have produced beef with less marbling (small pieces of fat scattered throughout the lean muscle of meat) and consequently less fat. Cattle are spending one-third less time in the feedlot in an effort to produce a leaner variety of cattle. Industry standards also have allowed the supermarket butcher to trim more fat from meat.

With the increased demand for lower fat and leaner meat products, the turkey industry has seen a dramatic increase in sales and pressure for development of new turkey products. Turkey is a wise meat choice because it is lean, low-fat, versatile, and less expensive than beef or pork.

Manufacturers have used turkey to create counterpart products such as turkey ham and turkey pastrami.

Another health issue that has brought many new products to the supermarket is the emphasis on a high-fiber diet. Oat bran received so much attention as a high-fiber product that would lower cholesterol that the supermarket shelves became flooded with products made with oat bran. Since then, consumers have learned that other foods have high amounts of soluble fiber as well. Although soluble fiber is known to help lower cholesterol, no one food alone can prevent heart disease or any other health problem. The lifetime practice of healthy eating and exercising reduces a individual's risk of developing diet-related diseases. The oat bran issue did succeed in increasing public awareness of the importance of a low-fat, high-fiber diet.

Functional Foods

Functional foods are foods that provide health benefits in addition to basic nutrition. Many foods can be considered functional foods. Consumers wanting to make gradual changes to eating a more nutritious diet should consider adding functional foods to recipes. Table 7.1 lists examples of these foods, the key health components found in the foods, and their potential health benefits.

New Products for Convenience

The typical American family now involves either a dual-income couple or a single working parent. This lifestyle change has brought about an increased demand for convenience food products. One area of convenience product development is the frozen, microwavable breakfast entree. Although most of these products are high in fat and sodium, they require only microwave heating and are packaged in disposable trays. The frozen food industry has been a leader in developing new convenience food products. Consumers can stroll down the frozen food aisle of the supermarket and choose a complete dinner or individual servings of meat dishes and vegetable combinations. Among the choices are foreign foods as well as fancy desserts in individual servings packages.

The emphasis on increased consumption of complex carbohydrates for healthy eating has brought new attention to pasta and rice dishes. The food industry has introduced a vast selection of prepared pasta sauces that can be heated and served. Many pasta sauces are sold with meat as an ingredient. Since preparation of the pasta only involves boiling in water for a short time, these products have become popular convenience items. Consumers continue to



see new products at the supermarket that meet the demands of taste, appearance, nutrition, and convenience.

◆ **Essential Questions:** ◆
Product Development

1. What consumer demands have had the greatest effect on the food industry?
2. What role does technology play in the processing and packaging of foods?
3. What are functional foods? What are their health benefits?

Examples of Functional Foods

Functional Food	Key Component	Potential Health Benefits
Black and green tea	Catechins	Reduce risk for cancer
Broccoli	Sulforaphane	Reduce risk for cancer
Fish	Omega - 3 fatty acids	Reduce risk for heart disease
Fruits and Vegetables	Many different phytochemicals	Reduce risk for cancer and heart disease
Garlic	Sulfur compounds	Reduce risk for cancer and heart disease
Oats and oat-containing foods	Soluble fiber beta glucan	Reduce cholesterol
Purple grape juice	Polyphenolic compounds	Support normal, healthy cardiovascular function
Soy foods	Soy protein	Reduce cholesterol
Tomatoes and tomato products	Lycopene	Reduce risk of cancer
Yogurt and fermented dairy products	Probiotics	Improve gastrointestinal health

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⇐ **Table 7.1**



Chapter Highlights

- ☆ Quality, storage, and preparation techniques all influence the amount of nutrients that are available in food.
- ☆ Perishable foods are those that deteriorate and spoil quickly. The quality of most fruits and vegetables is best when the produce is allowed to ripen on the vine, chilled immediately, and kept chilled until ready for use.
- ☆ Oxidation is a chemical change that occurs in foods as they age.
- ☆ Leaching is a term that refers to the loss of vitamins and minerals into water.
- ☆ Heat is a factor in nutrient retention because it speeds the loss of nutrients. However, heat also is required to destroy the harmful microorganisms in food that cause food-borne illness.
- ☆ Fruits and vegetables are most susceptible to nutrient loss because of their perishability.
- ☆ Nutrient loss can be due to oxidation, leaching, light, heat, manipulation, or pH levels.
- ☆ Microwave cooking, stir-frying, quick-freezing, dehydration, and freeze-drying are new trends in preparation and preservation methods that allow for the optimum retention of nutrients.
- ☆ Technology plays a major role in how foods are produced, processed, packaged, and shipped.
- ☆ Food technology is the application of the fundamentals of chemistry, biology, physics, and engineering to the problems of food preservation, including product development.
- ☆ Through genetic engineering, scientists produce varieties of grains and other plant foods that are resistant to drought and other environmental problems.
- ☆ Food scientists continue to develop new fat and sugar substitutes and new ways to use them in food.
- ☆ Meat analogues or meat replacements are food products made from plant proteins that have been shaped and formed to resemble meat products.



Chapter Highlights, Cont'd.

- ☆ Health and weight-conscious Americans have challenged the food industry to meet their demands with new and improved products.
- ☆ Packaging is the final step in the processing of food products. Not only does packaging protect foods from damage, it also protects foods from spoilage due to bacteria, heat, light, and oxygen.

Chapter 8

Food Processing and Product Development



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 3B Explain the chemical reactions that occur during food processing.
- 7B Assess methods of food processing and their impact on product quality and nutrition.
- 7C Explain the roles of additives in food processing.
- 7D Contrast the effects of packaging on the properties and quality of the food and on the environment.



Chapter Vocabulary

aseptic packaging
canning
extrusion
homogenizing
irradiation
laminates
microorganisms

pasteurization
polymerization
refrigeration
sublimation
synthetic chemical

FOOD SCIENCE

Food science is a diverse study that is defined as the application of science and engineering to the production, processing, distribution, preparation, evaluation, and utilization of food. Courses that address food

from a scientific angle are called food science courses. Food scientists include microbiologists, chemists, research specialists, engineers, quality control monitors, and others.

Nutrition is a science that derives information from scientific research. Practical

nutrition information is provided after scientists conduct research with studies and experiments. The results of research projects offer consumers a better up to date knowledge of food science. The following techniques are some characteristics of scientific research:

- Scientists' findings are critically reviewed before they are reported in a professional journal.
- Scientists realize that testimonials or "hear say" evidence is inadequate for scientific research.
- Scientists are careful not to generalize the findings to all people if only a small segment of the population was involved in the study.
- Scientists who use animals in their studies are careful not to overly interpret significance of their findings to humans.
- Scientists test ideas by repeating controlled experiments.

Nutrition scientists, like other scientists, use a standard process as they find answers to questions concerning food, nutrition, and health. Specific tools are present in every study or research project. Using research tools and following a specific process helps test and verify the answers to questions. Science is an integral part of food processing and product development.



METHODS FOR PROCESSING FOODS

Food processing includes all the methods of preparing food so that it is readily available to be used by the consumer. Food processing includes the washing, trimming, and sorting of fresh produce and the highly efficient methods of food preservation used by the food industry today. It is food processing that enables cattle, wheat, and sugar cane to become steak, milk, flour, and sugar.

Advancements in food processing in the United States have allowed consumers to have access to the widest selection of food items in the world while using the lowest percentage of income than any other country in the world.

People have been preserving food for thousands of years. Preserving includes the methods of preparing food so that it can be safely stored for long periods of time. For centuries, people have been plagued with the problem of manipulating the food supply so they have food to eat during long winter months or during seasons of bad weather. Historically, one of the major challenges for early civilizations was to provide a year-round food supply for their citizens.

Food manufacturing and processing can be traced back to early Egypt and Rome where bakeries made bread that was ready to eat. Until that time, individuals had to grind their own wheat, make the flour, and then bake their own bread. Original methods of food preservation included drying, freezing food outdoors during the winter, placing food in cold storage cellars, and curing with salt, smoke, spices, sugar, or vinegar. Colonial women preserved milk by making it into cheese. The canning process was invented in 1810. Since that time, safe, modern food preservation methods have provided American consumers with a year-round supply of a large variety of foods.

Food preservation is necessary to prevent food spoilage. Food spoilage can result from the growth of microorganisms or from pests such as insects and rodents. **Microorganisms** are the bacteria, molds, and yeasts that grow in food when given the proper environment. These microorganisms not only cause changes in the flavor, smell, and appearance of foods, but also can cause serious food-borne illness. The various methods of food preservation protect the food supply from food spoilage and allow for widespread storage and distribution of foods.

Food processing methods involve two areas. The first area involves the preservation of food. The second area involves methods of preparation that make the food suitable for use.

◆ **Essential Questions:** ◆
Methods for Processing Foods

1. What is food processing?
2. Why is food preservation needed?
3. What two areas are involved in food processing methods?

PRESERVATION METHODS

Modern technology has provided the food industry with a wide variety of food preservation methods from which to choose. This technology allows food manufacturers to select food preservation methods for individual foods that will allow for optimum nutrient retention, flavor, texture, and appearance. Consumers have come to expect only the highest quality food items from manufacturers. This broad list of food preservation methods includes the following:

- additives/chemical preservation
- aseptic packaging

- canning
- cold storage
- curing
- drying/dehydration
- fermentation
- freezing
- irradiation
- modified atmosphere
- pasteurization



Additives/Chemical Preservation Methods

Chemical preservation of food involves the addition of chemical substances as a means of preventing spoilage and retaining organoleptic properties such as color, flavor, odor, and texture. Organoleptic properties are those properties that involve the senses. Chemical preservation is also used to help retain nutrients in preserved foods. However, the main function of chemical preservation methods is to prevent microbial spoilage. Microbial spoilage occurs when microorganisms are allowed to grow within food products. Chemical preservatives are normally used as a part of another processing method such as heating. Some common additives or chemical preservation methods include acids, salts, sterilizing agents, sugar, and smoke.

Acids. Acids are used as preservatives in foods to reduce the pH level of the food. The pH level is the degree of acidity or alkalinity of a substance. All microorganisms have the ability to grow at certain pH levels. Most bacteria grow at pH levels of 5.0 to 7.0. Yeast and molds can grow at significantly lower levels. Table 8.1 shows the pH levels of common foods. Preservation with acids is usually combined with other methods such as heat pasteurization, refrigeration, or salting.

- **Vinegar** – Acetic acid is used in combination with sodium chloride (salt) in pickling. Growth of microorganisms is inhibited as long as these products are stored at low temperatures.

- **Citric Acid** — Citric acid, which is the acid found in limes and lemons, is most commonly used in tomato products. The addition of citric acid prohibits the growth of spore-forming bacteria.
- **Sorbic Acid** — Sorbic acid is most effective as an antimicrobial agent and is most useful in foods with low pH levels. It is found naturally in some fruits and berries, or it may be made in a laboratory. Sorbates are the sodium salts of sorbic acid and are also used as preservatives, especially in baked goods, cheese products, and dried fruit.
- **Sodium Benzoates** — Sodium benzoates are the sodium salts of benzoic acid. Benzoic acid occurs naturally in some plants such as anise seeds, cinnamon, cloves, and plums. Benzoates also inhibit growth of microorganisms and are used primarily in carbonated beverages, fruit juices, pickles, and sauerkraut.
- **Propionic Acid** — Propionic acid is made from bacterial fermentation and is found naturally in some dairy products. Propionic acid is used primarily as a preservative in bakery products. Propionic acid inhibits the growth of mold and bacteria in breads and cheeses.

Salts. Salt is one of the oldest known preservatives and is still very useful in prohibiting the growth of certain types of microorganisms. In some foods, salts are used in conjunction with water to form a brine. Brine is the name for the salt and water or salt and vinegar solution.

Sodium nitrite (or nitrite) is a preservative made either synthetically in the laboratory or as a result of the bacterial action in meat treated with sodium nitrate. This bacterial action converts nitrate into nitrite. Nitrite is used not only as an antimicrobial agent in cured meats but also to produce the color of cured meat products such as ham. Nitrite also develops and fixes the colors of cured meat products. Nitrite is known to prevent botulism and other food-poisoning bacteria.

Sterilizing Agent. Ethylene oxide is an antimicrobial agent used to sterilize spices.

Sugar and Smoke. Sugar and smoke are also effective preservatives. Sugar binds the water in food so that it cannot be used by microorganisms. Smoke contains guaiacol, which acts as an antioxidant. Antioxidants slow down the loss of nutrients and quality in food caused by oxidation. However, smoking is not suitable for meat and fish that need to be preserved for long periods of time. Most of the smoking of foods today is for the purpose of adding flavor. The Food Additive Amendment of 1958 restricts the use of chemicals in food to those that are approved by the Food and Drug Administration.

Aseptic Packaging

Aseptic packaging is a method of preserving food by sterilizing the food first and then packaging it in sealed, sterile containers in a sterile atmosphere or chamber. This process enables the food to be stored indefinitely without refrigeration. The most commonly used materials for aseptic packaging include foil-lined cartons, plastic bags, and cups for products, juice, and puddings. Aseptic packaged foods have a better flavor than the same foods packaged in cans or glass containers. Foods that are packaged in glass or cans require lengthy heating times for complete sterilization. Aseptic packaging allows the food to be sterilized before packaging so the heating time is greatly reduced. Flavor changes occur after lengthy exposure to heat. Aseptic packaging is becoming more prevalent because it is less expensive and more convenient than other methods of food preservation.

Canning

Canning is one of the most common types of food preservation used commercially and at home. Canning has been used as a method of food preservation since the early 1800s. Today, a wide variety of foods are canned because of their convenience and

extended shelf life. Some families own pressure canners so that they can safely preserve the vegetables from their home gardens. Canning involves sealing food in airtight containers and then heating them at high temperatures to destroy any microorganisms and spores that may be present. Commercial canning involves several steps which include the following:



1. *Raw food preparation* – washing, trimming, cutting, slicing, peeling
2. *Filling of containers* – Machines fill the metal or glass containers with the raw food product. Manufacturers must carefully judge the amount of head space that is left when filling the containers. Head space is the amount of space for air that exists between the food and the top of the container. If there is too much head space, the shelf life will be reduced. If there is too little head space, the containers could bulge during the heating process.
3. *Exhausting* – In commercial canning, exhausting creates a vacuum in the container by removing air from the product and the head space. A vacuum is necessary to ensure a good seal and to maintain container integrity (quality).
4. *Sealing* – Sealing involves closing the containers with airtight lids.
5. *Processing* – In this step, filled containers are placed in large cookers called retorts. Here they are heated at carefully calculated temperatures for specific lengths of time. The heat destroys the microorganisms that could cause food spoilage. Clostridium botulinum spores will not grow and produce toxins at a pH of 4.6 or less (acid). Foods above 4.6 must be pressure processed at high temperatures in order to kill the heat-resistant spores. The pH level is the degree of acidity or alkalinity of the food. Table 8.1 lists some pH levels of commonly eaten foods. Levels ranging

pH levels of Common Foods

<u>Food</u>	<u>pH Level</u>
Lemons	2.2
Cranberry sauce	2.3
Vinegar	2.9
Plums	2.9
Apples	3.1
Apricots	3.3
Strawberries	3.4
Peaches	3.5
Blueberries	3.7
Pears	3.9
Tomatoes	4.0 to 4.6
Carrots	5.0
Pumpkin	5.0
Green Beans	5.3
Asparagus	5.6
Potatoes	6.1
Corn	6.3
Milk	6.5-6.7
Hominy	7.0

Table 8.1

from 0 to 7 indicate acidity, and levels of 7 to 14 indicate alkalinity. It is during this step that some of the nutrients are lost and changes occur in flavor, color, and texture.

6. *Cooling* – When the processing time is concluded, containers are cooled quickly in order to prevent overcooking. Products may be air-cooled (cooled by circulating cool air) or submerged into cold water.

Home canning involves some of the same steps. It is important for the consumer who does home canning to be well informed of the necessary precautions needed for safe food preservation. County extension agents are excellent sources of information and instruction in home canning procedures.

Home canning involves the use of some special equipment. A large kettle called a boiling-water bath canner is used for canning acid foods such as tomatoes. However, due to the many varieties of low-acid tomatoes, the Texas A&M Agricultural Extension Service recommends that citric acid (such as lemon juice) be added to the jars immediately before filling them with the tomatoes. Nonacid foods, such as vegetables and meats, must be canned in a pressure cooker or pressure canner. These cookers have racks that hold several jars at a time. The two methods of home canning are the boiling-water bath method and the steam-pressure method.

In the boiling-water bath method, filled jars are placed on a rack in a large kettle. The kettle is filled so that the jars are completely covered by at least one inch of water. The processing time begins when the water starts to boil and continues for the recommended amount of time.

The steam-pressure method is used for low-acid foods because a higher temperature is required to kill the microorganisms in these foods. The pressure canner that is used in this method retains the steam inside the cooker so that the high temperatures can be reached and maintained for the length of the processing time. It is very important to follow the manufacturer's instructions to avoid injury and to ensure a safely canned food product.

Cold Storage

Cold storage is commonly referred to as refrigeration. **Refrigeration** is cold storage of foods at temperatures between 32°F and 40°F. The growth of the microorganisms that cause food to spoil is retarded at these temperatures. Cold storage also helps retain the flavor, color, textures, and nutrient value of the food by decreasing the enzyme activity. Cold storage (refrigeration) extends the shelf life of perishable foods such as milk and cheese.

Curing

Curing is one of the oldest methods of food preservation. In the curing process, ingredients such as salt, sodium nitrite or sodium nitrate, spices, and sugar are added to the foods. Sometimes smoke is used in curing or for the addition of flavor. Each of the ingredients has a different purpose. Salt removes part of the water from the food and slows down the growth of microorganisms. Sodium nitrite or sodium nitrate is used as a preservative and helps the food retain its color. Spices are added for flavor, and the sugar prevents the salt from hardening the food product. The chemicals in wood smoke act as a preservative because they retard the growth of microorganisms.

Drying/Dehydrating

Drying is another method of food preservation that can be traced back to ancient history. Drying or dehydrating preserves the food by removing the water or moisture that is needed by all microorganisms to grow and develop. A wide variety of dried foods are available to consumers. Different drying techniques are used for the different foods. These techniques include the following:

- **Drum drying** — The food is spread on a rotating drum and then scraped off when the drying cycle is completed.
- **Pulse-combustion drying** — This method is used for foods that cannot be dried by other methods. It uses sound waves and heat to dry the food.
- **Spray drying** — This is the method used for making dried milk powder. The liquid milk is sprayed into a heated chamber. When hot air is blown into the chamber, the liquid converts to a powdered form.
- **Sun drying** — This original method of drying involves spreading the food in thin layers and exposing it to the sun for a number of hours.
- **Tray drying** — Food is placed on trays and exposed to hot air circulation.

- **Tunnel drying** – The food is placed on conveyor belts in tunnels while exposed to circulating hot air.

Fermentation

Fermentation is a method of food preservation that uses the chemicals from acceptable microorganisms to bring about the desired changes in the food. These acceptable microorganisms used in fermentation include the following:

- **Yeasts** – Yeasts convert carbohydrates into alcohol or carbon dioxide. Yeast is used in the fermentation process to produce wine and distilled alcoholic beverages. Yeast is converted to carbon dioxide in bread making.
- **Molds** – Molds work with bacteria to produce strong-flavored cheeses.
- **Bacteria** – Bacteria work alone as cultures to produce other cheeses, yogurt, pickles, and salami.

Freeze-Drying

Freeze-drying is a method used in commercial food processing that produces a high-quality product that retains its original flavor, texture, and nutrient content better than foods dried by other methods. A process called **sublimation** is used to freeze-dry foods. In this process, ice turns into a vapor without becoming a liquid. The food is frozen and then placed on heated trays in a vacuum chamber. The trays are heated to a temperature just below melting, which allows the ice to vaporize. The resulting product is a dry solid with a soft, spongy texture. Freeze-dried foods do not become hard as other dried foods and are rehydrated very easily. Freeze-drying is a very expensive process, so its use is limited to very few food products such as coffee, instant soup mixes, mushrooms, onions, and strawberries.



Irradiation

One of the food preservation principles developed in the early 1950s is irradiation. **Irradiation** is a method of preserving food by exposing the food to ionizing radiation. These low doses of radiation kill bacteria and microorganisms that cause food spoilage and food-borne illness. After harvesting, the food is exposed to the radiation for a short time. Irradiation does not cause the food to become radioactive.

Irradiation has been approved to treat spices, fresh produce, poultry, and pork in the United States. The purposes of irradiation are to destroy harmful bacteria and microorganisms, to preserve the quality of the food, and to extend the shelf life of perishable food products. Irradiation has been successfully used in other countries to control the sprouting of potatoes and thus prevent spoilage of entire crops. Irradiation does not seem to change the appearance or taste and does not cause a major loss of nutrients.

Researchers in the United States have been studying irradiation for more than thirty years. Many other countries have approved the use of irradiation on different food products. Consumers have voiced concern over the use of irradiation in the food industry. Some concern arises from lack of factual information about irradiation and also from confusion between nuclear power radiation and food irradiation. Food irradiation technology is the same as that used in medical technology. The FDA continues to study the effects of irradiation on food.

Modified Atmosphere

Modified atmosphere, or controlled atmosphere, is a method of preserving foods by changing the chemical content of the air in the storage area. When the air in the storage area is changed by increasing the level of carbon dioxide and decreasing the oxygen, perishable food products such as fruits and vegetables can be stored for longer periods of

time without overripening or spoilage occurring. Different foods require different balances of chemicals in the stored atmosphere. This technique has proven to be very successful with apples, pears, and other types of produce.

Modified or controlled atmosphere storage also is used for products such as bacon, breads, cheeses, cooked meats, cream and jam-filled cakes, and bakery products. This method is also used to increase the shelf life of fresh meat, poultry, and fish. The techniques of modified atmosphere have been used in shipping perishable food products to extend the life and protect the quality of the transported products.

Pasteurization

Pasteurization was discovered by Louis Pasteur in 1895. Pasteur found that harmful bacteria in milk could be destroyed by heating it to a certain temperature and holding it at that temperature for a specified length of time. This process of sterilization was named pasteurization after its founder, Louis Pasteur.

The process of ***pasteurization*** is intended to kill all the bacteria that would be harmful to humans. Pasteurization also helps to extend the storage life of milk and to prevent rancidity.



◆ **Essential Questions:** ◆ **Preparation Methods**

1. What is modified atmosphere? Explain how it is used to preserve food?
2. What are the advantages and disadvantages of irradiation?
3. What differences are there in commercial and home canning?

PREPARATION METHODS

Preparation methods include those in which the food is changed or altered in some way prior to being processed or packaged for home or commercial use. These methods include the following:

- enzyme technology
- physical modification
- separation
- thermal modification

Enzyme Technology

Enzymes that naturally occur in foods are used in food processing. One method involves converting the starch found in foods such as corn and potatoes into dextrose. Dextrose is the crystal form of glucose that is widely used in commercial food processing. When the starch is heated, the enzymes allow the starch to be broken down into small units. High fructose corn syrups are made from corn-starch using enzyme technology. Enzymes also are used to clarify fruit juices in food processing.

Physical Modification

Many foods undergo some form of physical modification during food processing. Grinding, chopping, cutting, and slicing are all forms of physical modification. Physical modification is changing the food from one form to another. Grinding large roasts into hamburger meat is physical modification. The processing of ice cream involves whipping liquid ingredients with air in freezing temperatures.

The dairy industry uses physical modification in the homogenization process.

Homogenizing milk involves forcing liquid through a valve under high pressure. This process breaks up the fat globules into tiny particles so it is distributed throughout the milk and is not distinguishable by the consumer.

Separation

Separation as a means of food processing has been used for centuries. Ancient civilizations separated the fruits and nuts they gathered according to size, color, or ripeness. Today, separation procedures are much more sophisticated. Peas are immersed in salt brine and gravity separates the young, tender peas from the older, tougher ones. Fruits and vegetables are separated according to size and color for grading. The extraction of juice from fruits such as apples, cranberries, grapes, and oranges is a separation process. Leaching is used to separate the oils in corn, cottonseed, peanuts, soybeans, and sunflower seeds. Decaffeinated products result from the separation process. Caffeine in coffee and tea is separated from the coffee beans and the tea leaves.

Thermal Modification

Thermal modification involves the use of heat to modify the food into the desired product. Frozen fish sticks are examples of thermal modification. In this process, blocks of frozen fish are cut into strips, battered, and then deep fried for only a short time. The completion of the cooking takes place during home preparation. **Extrusion** is a process that forms food into desired shapes by using heat and special equipment called extruders. Breakfast cereals, some snack foods, such as cheese curls, some dog foods, meat analogues, and pasta, are all made by extrusion. Meat analogues or meat replacements are food products made from plant proteins that have been shaped and formed to resemble meat products.

◆ Essential Questions: ◆ Preservation Methods

1. What are some examples of physical modification in food processing?
2. How does the homogenizing process affect milk?

THE ROLE OF PACKAGING IN FOOD PROCESSING

Food manufacturers spend valuable time and money researching the best methods for packaging food products. All of the efforts of safe, efficient food processing are wasted if poor packaging results in a poor quality, damaged product arriving at the supermarket. The purpose of food packaging is to prevent deterioration or damage. However, food packaging not only continues to serve that purpose but also provides the consumer with content information (ingredients) and nutrition and serving size information.

Packaging also is used as a marketing tool through advertising, product design, and convenience features. Packaging has permitted food items to be sold through self-service. The technology of food packaging is extremely complex. The food manufacturers must consider many factors when selecting the proper type of packaging for individual food items. Figure 8.1 lists the factors to be considered.

Four main materials are used in food packaging today. These include glass, metal, paper, and plastics. When choosing the type of packaging material to use, the food manufacturer must consider the food composition and whether the food will be packaged in a liquid or solid state. The food manufacturer also must consider how the food will be stored, the cost of the packaging materials, and how the package will appeal to the consumer.

Glass

Glass is one of the oldest packaging materials and is still widely used today. The major advantages of glass packaging include the following:

- It cannot be penetrated by gases and odors.
- Glass has no effect on the chemical or physical properties of the food.
- It seals and reseals easily.

Choosing the Ideal Food Package: Factors to Consider

- Compatibility with the food
- Disposability
- Ability to be labeled appropriately
- Weight
- Does not contain or is not made of toxic materials
- Is appropriately opaque, translucent, or transparent
- Opens and closes as desired
- Can be used with high-speed filling machines
- Is protected from damage due to heat and cold
- Is protected from damage during shipping and storage
- Is protected from light
- Provides proper sanitation
- Can be sealed from gases and odors
- Is tamper-resistant

⇒ **Figure 8.1**

- It works well for high-speed mechanical filling.
- Glass is inexpensive to manufacture.
- It is transparent.
- Glass can be labeled easily with paper.
- Glass is recyclable.

Some disadvantages of glass include the following:

- Glass is breakable.
- It weighs heavy.
- It is not biodegradable.

Since the many advantages of glass far outweigh the disadvantages, consumers will continue to see foods packaged in glass for years to come.

Metal

Metal is used in food packaging mainly for canning. Metal is ideal for heat processing due to the following advantages:

- It is easily manufactured.
- Foods packaged in metal are protected from gases, light, and odors.
- Metal has heat transfer properties.
- Metal maintains an airtight seal.
- It protects food from damage during transportation and storage.

Some disadvantages of metal for food packaging include the following:

- Steel used in manufacturing cans is heavy.
- Steel cans are expensive to manufacture.

It is possible for the metal can to have a chemical reaction with the food contents. Therefore, the steel used to manufacture food cans is coated with either tin, enamel, plastic, or other coatings. Acidic foods cause corrosion of metal that has not been coated.

There are many sizes and types of metal food cans used today. Metal also may be combined with other materials such as paper or plastic for use in food packaging. Aluminum foil is commonly used in this manner. Metal also is used by the food industry for beverage containers and aerosol cans (such as those used for whipped cream).

Paper

Paper is probably the most widely used packaging material in the United States. Paper is a popular food packaging material because of its many advantages. These include the following:

- It is easy to manufacture.
- Paper is lightweight.
- It is inexpensive.
- Paper is printable.
- It is versatile.

Paper does have some disadvantages. It does not protect food from gases, grease, odors, and water. For this reason, paper is

often combined with other packaging materials, such as plastic films or foil. The combinations of these materials into multilayered materials are called **laminates**. Examples of laminates are milk cartons and some cookie packages.

Plastic

Plastic provides the food industry with versatile and flexible packaging material. The chemical process that creates plastics is called **polymerization**. Plastics used in food packaging today include cellophane, mylar, nylon, and saran. Plastics have many advantages as food packaging materials. These include the following:

- They can be formed into various shapes and sizes.
- They are heat sealable.
- They are inexpensive.
- They are not easily punctured.
- Some types are printable.
- They are stretchable.

Plastics vary widely in their permeability to all types of gases. This proves to be a disadvantage for use with some foods. Testing and experiments with plastics continue as food packaging engineers work to expand the use of plastic in the food industry.

Concerns over environmental issues have caught the attention of the food industry. Manufacturers and fast-food chain executives have received criticism for using packaging materials that are not biodegradable or recyclable. The food industry is working through research and development to change some of these practices.

American consumers would have to make many lifestyle changes without the many advantages of food packaging technology. Many of the foods most commonly used today would not be available if not for the advancements made in food packaging. Consumers would have to visit the supermarket daily to buy perishable foods that are now

conveniently packaged for extended shelf life. Besides having the safest, most abundant food supply in the world, Americans have the added advantage of reasonable cost and convenience.

◆ Essential Questions: ◆ The Role of Packaging in Food Processing

1. What is the purpose of food packaging?
2. What factors must food manufacturers consider when selecting the best type of food packaging?
3. How would you describe the ideal food package?

EFFECTS OF FOOD PROCESSING ON FOOD QUALITY

Procedures used in home preparation of foods can cause as much or greater losses of quality and nutritional value than in commercial food processing. Commercial food processing plants have highly specialized equipment that regulate the time and temperature to which food is exposed. The commercial food processor carefully controls the factors that affect the quality and nutritional value of the food. Family members who prepare meals do not have such specialized equipment in the home, and they may not be nearly as careful in food preparation methods.

A person who eats a variety of nutritious foods has a diet that meets the minimum daily requirements for most nutrients. Food composition tables show average differences between fresh and processed forms of food. Food labeling also shows nutrient content. To fully analyze the changes in quality, nutritive value, or taste that occur in food processing, a person needs to do experimental comparisons. Table 8.2 shows a comparison of foods in various forms according to nutrient value.

Selected Nutrient Values in Various Food Forms

Nutrient	Peas		Orange Juice		Salmon		Milk		Dietary Requirements for Adults (mg/day)
	Raw	Canned	Fresh	From Frozen Concentrate	Fresh, Broiled	Canned	Fresh (Pasteurized 3.5% fat)	Fermented (Buttermilk 0.1% fat)	
	mg/100 g								
Thiamin	0.3	0.1	0.1	0.1	0.2	—	—	—	1.2
Riboflavin	0.1	—	—	—	0.2	0.2	0.2	0.2	1.5
Niacin	2.9	0.8	0.4	0.3	9.9	7.4	0.1	0.1	18.0
Vitamin C	27.0	8.0	49.6	47.3	—	—	0.9	1.0	60.0
Calcium	26.2	26.2	10.8	10.0	—	—	118.0	122.0	1200
Iron	1.9	1.9	0.2	0.1	1.2	1.0	—	—	15
Phosphorus	116.8	77.0	16.8	16.8	417.3	288.2	90.8	95.7	1200
Potassium	318.4	96.6	198.4	198.4	446.4	339.1	143.4	141.1	2000

Source: Adapted from "Nutritive Value of American Foods," by C.F. Adams, Agriculture Handbook No. 456, United States Department of Agriculture, Washington, D.C.

Table 8.2

It is important to remember that while food processing may affect the retention of some nutrients, it also improves the digestibility or availability of other nutrients. For example, pasteurization destroys the trace amount of vitamin C found in milk. However, pasteurization of milk is necessary to destroy harmful bacteria that would make it unsafe, and Americans do not depend on milk to supply vitamin C. The cooking of meat causes some of the thiamin to be lost, but it improves the digestibility of the protein.

Changes in Food During Processing

The changes that occur in food products during processing or preparation generally serve three purposes. These purposes include the following:

1. To preserve the food
2. To improve the quality of the food product
3. To provide consumers with food products that taste better and are more convenient than in their original form

The various methods of food processing and food preservation have different effects on food. Some methods may sacrifice some quality in order to destroy harmful microorganisms. Other methods may be able to preserve quality and nutrition, but the process may be more expensive. The added cost is passed on to the consumer. Table 8.3 lists some common methods of food processing and the effects on food products.

Essential Questions: Effects of Food Processing on Food Quality

1. What is the difference between fresh and processed forms of food?
2. What are some changes that occur in food products and what purpose do the changes serve?

Basic Principles and Effects of Food Processing Methods		
Process	Principle of Preservation	Effects on Food
Chemical (Additives)	The growth of microorganisms is inhibited.	Quality, taste, texture, and color are retained. The function of ingredients is improved.
Curing (Pickling, Salting, Sugaring)	The addition of acids lowers pH levels, which inhibits microbial growth. Salt and sugar inhibit microbial growth by decreasing the availability of water.	Shelf life is extended. Texture and color may be affected.
Drying	The water that microorganisms need for growth is removed.	Flavor and appearance are affected. Some nutrients are lost. Shelf life is extended.
Fermentation	The acidity of the culture lowers the pH level, therefore reducing growth of microorganisms.	Flavor and appearance may be affected. Shelf life is extended.
Freezing	Low temperatures convert water to ice, which makes water unavailable to microorganisms for growth. It reduces enzymatic changes.	Texture may be affected, but color, flavor, and nutrients are retained.
Heat Sterilization (Canning)	Harmful microorganisms are destroyed. Enzymatic changes are reduced.	Some loss of heat-sensitive nutrients and water-soluble vitamins may occur. Flavor, texture, and color may change slightly. Lengthy shelf life stability is provided.
Irradiation	Beta or gamma rays are used to destroy harmful microorganisms.	Chemical reactions may affect flavor, color, or texture. Extended shelf life is provided.
Other Heat Sterilization Methods (Pasteurization, Smoking)	Harmful microorganisms are destroyed.	Heat-sensitive nutrients are lost. Shelf life is extended.
Refrigeration	Growth of microorganisms is slowed down or stopped by the low temperatures.	Flavor, color, and texture is retained, but the shelf life is very short. After periods of time, microbial growth can occur.

Table 8.3

CHEMICAL REACTIONS DURING FOOD PROCESSING

All foods are made of chemicals. Some chemicals occur naturally in foods from plants and animals. Other chemicals have been duplicated in laboratories and are known as *synthetic chemicals*. When food is processed, regardless of the method used, chemical reactions take place. These are desired chemical reactions because they bring about the desired change in the food product that improves the quality of the product or retards spoilage. These chemical reactions perform the following functions:

- destroy or prevent the growth of harmful or destructive microbes
- eliminate or control toxins
- maintain nutritional quality
- maintain desirable odors and textures
- increase shelf life of foods

Table 8.4 lists the factors involved in these chemical reactions.

The food processing industry of today incorporates aspects from seven different fields of science. These include the following:

- agricultural science
- chemistry
- economics
- engineering
- marketing
- microbiology
- nutrition

It is the combined knowledge and information gathered from all of these areas that have brought the food processing industry to such a sophisticated level. Future plans for the food industry in the 21st century invite many new and exciting products yet to come.

◆ Essential Questions: ◆ Chemical Reactions During Processing

1. What are the functions performed by the chemical reactions that occur in food during food processing and food preservation?
2. How are seven different fields of science involved in the food processing industry? Give examples.

Factors that Influence Chemical Reactions in Food

Factor	Chemical Reaction
Acidity	The presence of acid in food lowers the pH level. The acid inhibits microbial growth.
Nutrients	In some foods, nutrients may be bound to other chemical compounds. This makes them unavailable for use by the body.
Oxygen	Oxygen is the principal factor needed for the growth of most living organisms. The absence of oxygen in some preservation methods inhibits the growth of microorganisms.
Temperature	Most microorganisms experience optimum growth at temperatures between 60°F and 120°F. Some microorganisms can survive in much colder temperatures of 32°F to 40°F. That is why extreme heat and freezing temperatures are used in food preservation.
Water	Water is one of the most important nutrients needed by microorganisms for growth. Water that is not bound by any other agent, such as salt, is "free" to be used by the microorganisms. When salt or sugar is added to food, the water is bound to the salt or sugar and is not available for use by the microorganisms. The same action occurs in freezing. The freezing temperature converts the water to ice, which cannot be used for microbial growth.

= *Table 8.4*

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Chapter Highlights

- ☆ Food science is a diverse study that is defined as the application of science and engineering to the production, processing, distribution, preparation, evaluation, and utilization of food.
- ☆ Food processing includes all the methods of preparing, preserving and packaging food so that it is readily available to be used by the consumer.
- ☆ Food preservation is necessary to prevent food spoilage. Food spoilage can result from the growth of microorganisms or from pests such as insects and rodents. Microorganisms are the bacteria, molds, and yeasts that grow in food when given the proper environment.
- ☆ Drying or dehydrating preserves the food by removing the water or moisture that is needed by all microorganisms to grow and develop.
- ☆ The purpose of food packaging is to prevent deterioration or damage and provide the consumer with content information, nutrition, and serving size information.
- ☆ When food is processed, regardless of the method used, chemical reactions take place.
- ☆ The changes that occur in food products during processing or preparation serve these purposes:
 - to preserve food
 - to improve the quality of the food product
 - to provide consumers with food products that are more palatable and convenient than in their original form
- ☆ Aseptic packaging is a method of preserving food by sterilizing the food first and then packaging it in sealed, sterile containers in a sterile atmosphere or chamber.
- ☆ Irradiation is a method of preserving food by exposing the food to ionizing radiation.
- ☆ The process of pasteurization is intended to kill all the bacteria that would be harmful to humans.

Chapter 9

Food Safety and Sanitation



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 8A Describe properties of microorganisms that cause food spoilage and foodborne illness.
- 8B Outline sanitation and food-handling practices that can help prevent food contamination and foodborne illness.
- 8C Describe functions of government agencies that regulate food quality, wholesomeness, and safety.
- 8D Analyze industry quality control standards and skills related to safety and safe working conditions.



Chapter Vocabulary

adulteration	intrastate commerce
bacteria	microbial contaminants
chemical properties	molds
contamination	physical properties
danger zone	rancidity
Delaney Clause	recalls
environmental contaminants	shelf life
fill-of-Container	Standards of Identity
foodborne infection	Standards of Quality
foodborne intoxication	viruses
Hazardous Analysis Critical	yeasts
Control Point (HACCP)	
interstate commerce	

Food safety is a topic of interest and concern for professionals in the food industry as well as for consumers. Most questions concerning food safety arise out of concern over a particular additive, environmental contaminant, or the presence of a dangerous microorganism, such as botulism. Consumers need to be informed about food safety practices in food processing plants and in the home.

CONTAMINATION OF FOOD

Food is composed of many chemical compounds. All of the animal, fish, fowl, and plant products that people eat are made up of a variety of chemicals. Some of these chemicals contribute nutritional value to food, while others simply contribute color and flavor. All of these chemicals enter the human body through the consumption of food. However, some chemical substances of either natural or synthetic origin can contaminate food.

Contamination occurs when food comes in contact with something that is impure or harmful and causes the food to be unsafe. Food can become contaminated by adulteration, growth of microorganisms, or exposure to some form of environmental contaminant. **Adulteration** occurs when a harmful substance is added to the food that makes it unsafe.

Environmental Contaminants

Environmental contaminants are hazardous chemicals that are found in food as a result of some environmental source. The two possible sources of environmental contaminants include the following:

1. The release of synthetic chemicals into the environment, especially into waterways
2. Contaminants found in the soil from natural sources such as geological formations



The Food and Drug Administration (FDA) has established regulations for acceptable levels of contaminants in food. The FDA continually monitors the food supply to ensure its safety.

Microbial Contaminants

Microbial contaminants are harmful microorganisms that grow in food and can cause serious illness and even death. The hazards of foodborne illness can be avoided by sanitary food handling and effective food preparation techniques. To reduce the effects of contamination, the growth of microorganisms must be slowed by refrigeration or destroyed by heat. At temperatures between 41°F and 140°F microorganisms grow and multiply greatly in a very short amount of time. To prevent microorganisms from growing and multiplying rapidly, food must be kept out of this **danger zone**.

At least one million people in the United States suffer from foodborne illnesses each year. Microbiological hazards account for most cases of foodborne illness. Microorganisms are tiny living cells that can be seen only with a microscope. Microorganisms are everywhere—in the body, in the soil, in the water, and in the air. The four types of microorganisms that affect food are bacteria, viruses, yeasts, and molds. See Figure 9.1 for a microscopic view of types of microorganisms.

Foodborne illnesses caused by microbiological hazards are classified as either infections or intoxications. A **foodborne infection** is a disease caused by eating food containing harmful microorganisms. A **foodborne intoxication** is an illness caused by poisons or toxins in the food a person eats. The toxin may occur naturally in the food, as in certain mushrooms, or the food may be contaminated by toxins produced by certain microorganisms.

cream, cheese slices, jams and jellies, tomatoes, and cucumbers with mold spots should be discarded.

Freezing prevents the growth of molds but does not kill those already present in food. Some molds give a musty odor and flavor to foods. Some people have developed allergies to certain molds. These allergies affect the sinuses, eyes, ears, and respiratory tract. Table 9.1 and Table 9.2 list important information about foodborne illnesses. Figure 9.2 lists important information about foodborne illnesses.

Food Safety Guidelines: Avoiding Foodborne Illness

- Refrigerate or freeze leftovers immediately after use.
- Thaw frozen foods in the refrigerator, never on the counter. The warm temperature is a perfect environment for microorganisms to thrive.
- Keep hot foods hot and cold foods cold. Lukewarm temperatures allow bacteria to grow.
- Use a meat thermometer when cooking meat and poultry. Insert the thermometer in the thickest part of the meat away from the bone. For poultry, the internal temperature should reach 180° to 185° F.
- Use a different cutting board and different utensils for preparing fruits and vegetables than is used to prepare raw meat and poultry.
- Carefully wash all utensils used to prepare raw meat and poultry in hot, soapy water.
- Wood cutting boards can be thoroughly cleaned in a bleach and water solution. The bleach will kill any bacteria left on the cutting board.

⇒ *Figure 9.2*

◆ Essential Questions: ◆ Contamination of Food

1. How does food become contaminated?
2. What is food adulteration?
3. What are four types of microorganisms that contaminate food?

SAFE FOOD STORAGE

Storing foods properly is important for maintaining quality and nutrients. Types of food storage include freezing, refrigeration, and dry storage.

Freezing

Freezers are useful for long-term storage of many perishable foods. However, lengthy freezer storage increases opportunities for contamination and spoilage. Many frozen foods deteriorate rapidly.

Freezing has little if any effect on flavor, texture, color, and nutritional value. Most foods can be frozen successfully with the exception of a few food products including lettuce, raw cabbage, raw celery, mayonnaise, potato salad, gravies, sauces, puddings, custards, cream pie fillings and other creamed foods, hard cooked egg whites, and watermelon. Items that deteriorate in freezer storage include hamburger, fatty fish, turkey, and pork. Processed meats, such as ham and luncheon meats, should not be frozen. Doing so decreases the flavor and appearance.

For safe and efficient freezer operation, the following guidelines should be observed:

- Maintain an air temperature of 0°F or below.
- Use one or more easily visible thermometers to monitor freezer temperatures.

Types of Microorganisms

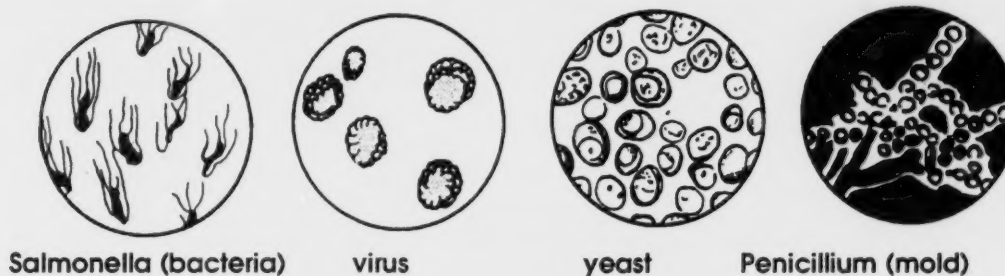


Figure 9.1

Bacteria are small, single-cell organisms that can live anywhere people can. They thrive in a warm, moist environment that is neutral or slightly acidic. Bacteria are more commonly involved in cases of foodborne illness than are viruses, yeasts, and molds. Common names of some foodborne illnesses of bacterial origin are staph, botulism, perfringens poisoning, salmonellosis, and listeriosis. The bacteria that cause the illnesses are *Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens*, *Salmonella*, *Listeria monocytogenes*, *Escherichia coli* (E coli), and *Campylobacter jejuni*.

Viruses are the smallest and perhaps the simplest form of life known. They cause illnesses such as colds, influenza, and infectious hepatitis. Unlike bacteria, viruses cannot grow and multiply on their own but must depend on a living host to reproduce. The living host is the organism in which another organism (such as the virus) lives for nourishment. For this reason, viruses do not increase in number while they are in food. The food merely transports the viruses, which may then lodge themselves in the human host and produce abundantly.

Viruses seem to vary in their reaction to heat and cold. The influenza virus is very sensitive to heat. Other types of virus have been shown to survive in food at temperatures as high as 176°F and remain active after

storage in a refrigerator for more than one year.

Yeasts are fungi that require sugar and moisture for survival. Yeasts often consume these ingredients in food products and spoil the food in the process. Yeast organisms can be killed by heating to 136°F (56°C) for about fifteen minutes. In general, yeast spoilage can often be recognized by the presence of bubbles and an alcoholic smell or taste. Yeast spoilage can create a slime on fruit juices or pickle brine (the solution in which pickles are preserved) or a pink discoloration in cottage cheese. However, no evidence suggests that yeast-producing diseases in humans are transmitted by food or that yeasts occurring naturally in foods are harmful to humans.

Like yeasts, molds are fungi that may or may not be harmful to humans. **Molds** are fuzzy-looking fungi that can grow on almost any food at almost any storage temperature, under almost any conditions—moist or dry, acidic or nonacidic, salty, or sweet. The color of mold is usually white but also can be blue-green, orange, black, gray, or even red. Certain molds produce toxins that have been known to cause cancer in animals. Spots of mold can be cut off the surfaces of some hard cheeses and firm vegetables. At least one inch should be cut off around and below the mold spot. Soft food items such as yogurt, sour

Common Foodborne Illness of Bacterial Origin

Illness	Bacteria Responsible	Description	Habitat	Types of Foods	Symptoms	Cause	Temperature Sensitivity
Staphylococcal intoxication	<i>Staphylococcus aureus</i>	Produces a heat-stable toxin.	Nose and throat of 30 to 40% of healthy population; also on skin and superficial wounds.	Meat and seafood salads, sandwich spreads, and high-salt foods.	Nausea, vomiting, and diarrhea within 4 to 6 hours. No fever.	Poor personal hygiene and subsequent temperature abuse.	No growth below 40°F. Bacteria killed by normal cooking.
Salmonellosis infection	<i>Salmonella</i>	Produces an intestinal infection.	Intestinal tracts of animals and humans.	High-protein foods — meat, poultry, fish, and eggs.	Diarrhea, nausea, chills, vomiting, and fever within 12 to 24 hours.	Contamination of ready-to-eat foods, insufficient cooking, and recontamination of cooked foods.	No growth below 40°F. Bacteria are destroyed by normal cooking.
Perfringens poisoning infection	<i>Clostridium perfringens</i>	Produces a spore and prefers a low-oxygen atmosphere. Live cells must be ingested.	Dust, soil, and gastrointestinal tracts of animals and humans.	Meat and poultry dishes, sauces, and gravies.	Cramps and diarrhea within 12 to 24 hours. No vomiting or fever.	Improper temperature control of hot foods and recontamination.	No growth below 40°F. Bacteria are killed by normal cooking, but a heat-stable spore can survive.
Botulism intoxication	<i>Clostridium botulinum</i>	Produces a spore and requires a low-oxygen atmosphere. Produces a heat-sensitive toxin.	Soil, plants, marine sediment, and fish.	Home-canned foods.	Blurred vision, respiratory distress, and possible death.	Improper methods of home-processing foods.	Type E and type B can grow at 38°F. Bacteria destroyed by cooking and the toxin is destroyed by boiling for 5 to 10 minutes. Heat-resistant spore can survive.
Listeriosis infection	<i>Listeria monocytogenes</i>	Survives adverse conditions for long time periods.	Soil, vegetation, and water. Can survive for long periods in plant materials.	Milk, soft cheeses, and vegetables fertilized with manure.	Mimics meningitis. Immuno-compromised individuals most susceptible.	Contaminated raw products.	Grows at refrigeration (38°F to 40°F) temperatures. May survive minimum pasteurization temperatures (161°F for 15 seconds).

Adapted from: *Bacterial Food Poisoning*. Al B. Wagner, Jr., Texas Agricultural Extension Service, The Texas A&M University System.

⇨ **Table 9.1**

Foodborne Illness: Emerging Pathogens

Illness	Bacteria	Description	Habitat	Types of Foods	Symptoms	Cause	Temperature Sensitivity
Campylobacter infection	campylobacter jejuni	Produces a powerful toxin resulting in severe illness.	Intestinal tract of humans; animals, especially cattle	Raw and undercooked beef and other red meats, imported cheeses, unpasteurized milk, raw finfish, cream pies, mashed potatoes, and other prepared foods.	Bloody diarrhea; severe abdominal pain, nausea, vomiting, diarrhea, and occasionally fever.	Under cooked red meat, raw fish, unpasteurized dairy products, contaminated food and water supply, fecal contamination by food handlers.	Temperature above 160°F required to kill bacteria.
Ecoli infection/intoxication	Escherichia coli	A group of spiral-shaped bacteria that cause disease in humans and animals.	Domestic and wild animals	Raw vegetables, unpasteurized milk and dairy products, poultry, pork, beef, and lamb.	Diarrhea, fever, nausea, abdominal pain, headache.	Insufficient cooking, cross-contamination, contaminated raw products.	Temperatures above 170°F for breast meat of poultry and 180°F for thigh meat of poultry required to kill bacteria.
Norwalk virus illness	Norwalk and Norwalk-like agent	The prototype of a family of small, round-structured viruses causing gastroenteritis.	Humans (intestinal tract)	Raw vegetables, prepared salads, raw shellfish, and water contaminated from human feces.	Nausea, vomiting, diarrhea, abdominal pain, headache, and low-grade fever.	Contaminated food and water supply; fecal contamination from food handlers due to poor personal hygiene, insufficient cooking.	Cooking temperatures at boiling or above are adequate to inactivate the virus.

Adapted from: *Bacterial Food Poisoning*, Al B. Wagner, Jr., Texas Agricultural Extension Service, The Texas A&M University System.

☞ **Table 9.2**

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- Defrost freezers as often as recommended by the manufacturer.
- Store frozen foods promptly.
- Store frozen foods in moisture-proof materials or containers.
- Store frozen-food products in the cartons in which they were packaged. Repackage if carton is broken or space is not available for original cartons.
- Open the freezer only when necessary and remove as many items as possible at once.
- Remove from storage only the quantities of frozen food that can be used immediately.

Frozen food should be defrosted only by using one of the following four methods as recommended by the United States Department of Agriculture (USDA) and the Frozen Food Handling Code:

- Defrost according to the manufacturer's instructions.
- Defrost in a refrigerator with a temperature not greater than 45°F.
- Defrost under drinkable running water at a temperature not greater than 70°F, and cook immediately.
- Defrost in a microwave oven or in conventional cooking equipment as long as the thawing and cooking process are continuous.
- Never defrost foods on the counter top at room temperature.

Refrigeration

Refrigeration is used for short-term holding of perishable food items. Refrigeration slows the growth of bacteria in foods but does not destroy bacteria already present in foods.

Meats, fish, and dairy products require the lowest refrigeration temperatures while fruits and vegetables need higher temperatures. Refrigerator storage temperatures should remain between 32°F and 40°F. The cold storage of food is important to keep bacteria from growing. Food items with potential to leak should not be stored above other food items. These items must be stored

on the lowest racks so the possibility of contaminating other food does not exist. For example, thawed meat in a pan of meat juices stored above other food in a cooler could contaminate the other food if the juice spills or leaks from its container. When placed on the lowest rack, the food would spill on the floor of the refrigerator, not on other foods. For safe and efficient refrigerator operation, the following guidelines should be observed:

- Do not overfill refrigerators. Overfilling makes cleaning difficult and may prevent air circulation necessary for maintaining proper temperatures.
- Store all foods in clean, nonabsorbent, covered containers or in original packages.
- Allow space between containers to ensure air circulation.
- Avoid lining shelves. It interferes with air circulation.
- Avoid adding large amounts of warmer foods to the refrigerator at once. Divide large amounts of food into small containers and shallow pans to ensure thorough quick cooling. Stir periodically if necessary.
- Open a refrigerator only after identifying products needed, not before. Make as few trips to the refrigerator as possible.

Dry Storage

Dry storage areas should be well ventilated, well lighted, clean, and protected from pests and excessive moisture. Dry storage areas should be cool, dry, dark areas with temperatures from 50°F to 70°F. A temperature of 50°F increases the shelf life of many products. The **shelf life** refers to the length of time a product can be stored without serious change in quality. Storing dry goods in temperatures above 70°F increases the chance of spoilage. The likelihood of spoilage rises sharply as storage temperatures rise. A relative humidity of 50 to 60 percent is satisfactory for most foods in dry storage. Adequate ventilation is necessary to maintain the quality of foods in dry storage and to prevent insect infestation.

Cans, jars, and bottles that do not need refrigeration may be stored in dry storage. Packaged foods such as rice, seasonings, and grain products also may be placed in dry storage. Packages that have been opened should be resealed or transferred to a container with a tight-fitting lid. Canned foods that have leaks, bulges, or uncommon odors should not be used. See Figure 9.3 for guidelines for handling food safely.

To ensure safety and sanitation in a dry storage area, the following guidelines should be observed:

- Never store food directly on the floor.
- Never keep garbage where food is stored.
- Store heavy and bulky items on shelves or in bins closest to the floor.
- Keep the area swept, and clean it regularly.

◆ Essential Questions: ◆ Safe Food Storage

1. What are the safe methods of defrosting frozen foods?
2. What is shelf life?
3. What are some guidelines for safe dry storage?

HACCP SYSTEM

The *Hazardous Analysis Critical Control Point (HACCP)* concept outlines the quality control procedure used by the food industry in food production plants and food distribution outlets to identify possible sources of contamination in food substances. This system was developed by the food industry for

Hands on Food Safety Tips

- ✓ *Refrigerate or freeze leftovers immediately after use.*
- ✓ *Thaw frozen foods in the refrigerator, never on the counter. The warm temperature is a perfect environment for microorganisms to thrive.*
- ✓ *Keep hot foods hot and cold foods cold. Lukewarm temperatures allow bacteria to grow.*
- ✓ *Use a meat thermometer when cooking meat and poultry. Insert the thermometer in the thickest part of the meat away from the bone. For poultry, the internal temperatures should reach 180° to 185° F.*
- ✓ *Use a different cutting board and different utensils for preparing fruits and vegetables than is used to prepare raw meat and poultry.*
- ✓ *Carefully wash all utensils used to prepare raw meat and poultry in hot, soapy water.*
- ✓ *Wood cutting boards can be thoroughly cleaned in a bleach and water solution. The bleach will kill any bacteria left on the cutting board.*

⇨ Figure 9.3

The HACCP System

The hazard analysis critical control point procedure consists of three hazard categories:

Category 1

Hazards caused by the ingredients in the unprocessed product

The food product may contain an ingredient or ingredients that could introduce potentially pathogenic organisms or toxins in food or that may have a flavor, color, or nutrient which can change during processing.

Category 2

Hazards related to the manufacturing process

The manufacturing process may not effectively destroy harmful bacteria; it may decrease the strength of any protective elements in the food which prevent contamination, or it interferes with the maintenance of quality in the food.

Category 3

Hazards caused by inadequate planning for storage and distribution

During the distribution process, the storage period, or in the handling by consumers in retail outlets, the quality or safety of the product could be reduced due to lack of adequate packaging or sufficient levels of chemical preservatives in the product.

⇨ **Figure 9.4**

use as a quality control tool. The hazard analysis part of the HACCP concerns identifying critical points, such as sensitive ingredients or possible steps in processing, that must be monitored to assure a safe food product. The critical control points are those steps in the food production process where quality control errors can result in an unsafe food product. Figure 9.4 shows the HACCP system.

The HACCP concept provides the food industry with a system of checks and balances that monitors the quality control procedures. Therefore, if something goes wrong, appropriate action can be taken and the problem can be resolved in a minimum amount of time.

QUALITY CONTROL

The major function of the quality control department is to monitor all the raw food products that arrive at the food processing plant as well as the processed food products that leave the plant. The personnel working in the quality control department have many responsibilities including the following:

- Having knowledge of all major areas of food processing
- Ensuring compliance with standards of identity for manufactured food products
- Ensuring compliance with government regulations for the use of additives
- Monitoring microbial content of ingredients and food products

- Evaluating sensory qualities of final products
- Ensuring that all final products meet required standards, regulations, and food laws

The food scientists that work in quality control departments are the key people in food processing plants that ensure the safety of the food products that appear in the supermarket.

◆ **Essential Questions:** ◆
HACCP System and Quality Control

1. What is the purpose of the HACCP?
2. What are the three categories in the HACCP system?

QUALITY OF FOOD PRODUCTS

With the growing number of products available on the market today, average consumers do not have the time or the ability to inspect and evaluate the foods they purchase. With the variety of package shapes and sizes, it is often difficult for the manufacturer to provide enough useful information for consumers so that they can make wise selections. Several laws have been passed to ensure consumers that they can buy foods that meet specified standards of wholesomeness. The present laws cannot guarantee consumers that all inferior foods and misleading packaging have been eliminated, but laws provide the best means to regulate the food industry.

Food safety and the need for regulations became a major concern in the 1800s. The first law regarding food standards of content and quality was the British Food and Drugs Act passed in 1860. Subsequent regulations were passed in almost every country.

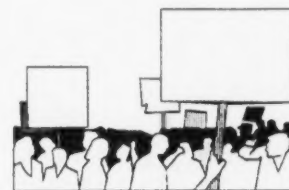
UNITED STATES FOOD LAWS AND REGULATING AGENCIES

Commerce refers to the buying and selling of goods. All meat and poultry sold in *interstate commerce* (between states) or *foreign commerce* (with other countries) must be inspected by the federal government for wholesomeness and truthful labeling. There are many local, state, and federal agencies that regulate the safety of the food produced and eaten in the United States. Similar organizations regulate food in other countries. Meat and poultry bought and sold *intrastate* (within a state) must be inspected by state inspectors following guidelines that are at least equal to federal regulations. If a state is unable to inspect and regulate its own program, the United States Department of Agriculture (USDA) Food Safety and Inspection Service must assume the responsibility. In addition to inspecting, USDA officials examine shipments of meat from other countries to identify uninspected meat and poultry, imitation or false inspection stamps used to deceive or defraud the quality of the product, inaccurate labels, and unwholesome products.

Food Laws

The numerous food regulating agencies in the United States receive their authority or power and funding from the numerous food laws that have been passed. Many of the laws passed have been replaced or revised at some

point in time. Some regulations may be the responsibility of one agency or may require the combined efforts of two or more agencies.



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The Federal Food, Drug, and Cosmetic Act of 1938 authorized the Food and Drug Administration (FDA) to regulate food, drug, and cosmetic production to ensure that products were safe, pure, and wholesome. The FDA was also authorized to ensure that products were made or processed under sanitary conditions and were honestly packaged and labeled. The FDA was to establish food standard regulations regarding product packaging. Minimum standards were set for tenderness, color, and defects. Standards for enrichment (addition of nutrients to a product) were set with regulations implemented for products labeled as "enriched" or "fortified" (nutrients not naturally present are added). The act also provided standards for certain additives in products that are added unintentionally and are not necessarily desirable in foods. These unintentional additives may be added to products because they are either necessary in production or unavoidable.

The Miller Pesticide Amendment of 1954 established acceptable levels for pesticides and chemical residues used on agricultural products. Pesticides are chemicals used to kill insects on plants. Occasionally, the chemical in the pesticide can leave a harmful residue on the plants. Any pesticide used must be approved by the USDA as well as the FDA.

The Food Additives Amendment of 1958 made it necessary for a manufacturer to demonstrate the safety of a new additive before its use could be approved by the FDA. This amendment also included the *Delaney Clause* which stated that no additive would be considered safe if it were found to produce cancer when ingested by man or animals or if it were found to cause cancer in man or animals.

The Fair Packaging and Labeling Act of 1967 required that all labels on packaged foods contain four important facts. These facts must be clearly printed on the label.

1. Identity of the food
2. The name and address of the manufacturer, packer, and distributor

3. Net contents (actual weight without the package) of the product
4. Ingredients — must be listed on a single panel with the common names of the ingredients appearing in decreasing order of percentages

The FDA has amended the process of the food labeling regulations. The Nutrition Labeling and Education Act of 1990 (NLEA) became law on November 8, 1990 and has led to significant changes in food labeling regulations. These regulations address three areas: the nutrition label, nutrient content claims, and health claims. See Figure 9.5.

The Egg Products Inspection Act of 1970 is administered by the USDA. The act is intended to assure that the eggs and egg products that reach the consumer are wholesome and free of harmful substances. The act provides that the Agricultural Marketing Service be responsible for the continuous mandatory (required) inspection in plants that process liquid, dried, or frozen egg products.

Eggs are one of many products that are imported into the United States. To import is to bring items into a country from another country to be sold. Eggs are also exported. Export means to carry or send items to other countries to be sold and consumed there. Eggs and egg products may be imported from foreign countries only if the country's inspection system is equal to that of the United States.

Agencies That Oversee Food Quality and Wholesomeness

Many agencies have been established to oversee food quality and wholesomeness in the United States. Many of these agencies are regulatory or managing agencies. The USDA is one of many agencies that regulates food and beverages in the United States. Other agencies serve as sources of information and

Mandatory Nutrition Labeling (1990)

- ✓ Nutrition labels are required on almost all packaged foods.
- ✓ Revision of the list of nutrients whose content levels are required to be shown on the nutrition label.
- ✓ Use the new format for nutrition labeling
- ✓ Provide more consistent serving sizes across product lines to reflect the actual amounts people really eat.
- ✓ Must list 14 nutrients
- ✓ Nutrients must be listed in this order:
 - Calories
 - Calories from fat
 - Total fat
 - Saturated fat
 - Cholesterol
 - Sodium
 - Total carbohydrate
 - Dietary fiber
 - Sugars
 - Protein
 - Vitamin C
 - Calcium
 - Iron
- ✓ Other vitamins and minerals for which RDI's have been established must be declared if a claim is made about them or if they have been added as a nutrient supplement.
- ✓ The new label is to be titled "Nutrition Facts"
- ✓ Label must be easy to read
- ✓ Label must comply with defined serving sizes

Source: U.S. Food and Drug Administration.

⇒ **Figure 9.5**

guidance to the industry and the public. Some of these agencies are listed as follows:

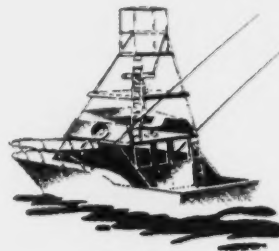
- *The Bureau of Alcohol, Tobacco, and Firearms* is responsible for enforcing the laws that cover all aspects of the alcoholic beverage industry. Wine beverages that contain less than 7 percent alcohol are the responsibility of the FDA. The bureau and the FDA share responsibility in cases where alcoholic beverages have been adulterated or made unsafe with food or color additives, contaminants, or pesticides.
- *The Centers for Disease Control* is a branch of the Department of Health and Human Services that helps inform the public of diseases and food-related illnesses. However, it is not a regulatory agency. The Center becomes involved in situations or isolated cases where foodborne illnesses or diseases cause a threat to individuals and

the public as a whole. If a person eats a particular brand of food and the person gets food poisoning, the Center would not only investigate the situation but would also help local health authorities pass the information along to the public. The Center would also be involved in removing the product from the grocer's shelves or from the factory or plant so that the contaminated product could be destroyed and not cause further damage.

- *The Environmental Protection Agency (EPA)* regulates pesticides and pesticide use. Before any pesticide can be sold or used in the United States, it must be approved by the EPA. The EPA also establishes acceptable levels of pesticides in foods. Another responsibility of the EPA is establishing water quality standards.
- *The Federal Trade Commission (FTC)* is an agency that protects consumers at the state and local levels. The FTC has the authority to regulate the following:
 - product pricing to increase fairness to consumers and competitive products
 - deceptive advertising such as exaggerated claims for a product
 - deceptive packaging
 - deceptive selling
- *The Food and Drug Administration (FDA)* is a part of the Department of Health and Human Services' Public Health Service and is responsible for enforcing the Food, Drug, and Cosmetic Act of 1938. The FDA is responsible for the safety and quality of all foods involved in interstate commerce with the exception of meat, poultry, and eggs. Meat, poultry, and eggs are inspected by the USDA. The FDA has the shared responsibility with other agencies to enforce the safety and sanitation regulations of certain products. Packaging, labeling, and egg product inspections are regulated.

The FDA monitors recalls of unsafe or contaminated foods. **Recalls** refer to the process of ordering a return of a specific product so that the manufacturer can repair a particular defect or replace the product if it is unsafe. Products found to be in violation of federal regulations can be seized and removed from the grocer's shelves or the factory by the federal courts. The individuals or firms responsible for the violations may be arrested. The FDA is also responsible for nutrition labeling.

- *The National Marine Fishery Service* is a division of the United States Department of Commerce. Its primary responsibility is to regulate seafood quality and various aspects of the seafood industry. There are no mandatory inspections or grading standards for seafood, but a voluntary inspection program is available to those requesting it.



- *The United States Department of Agriculture (USDA)* enforces standards for quality of meats, poultry, eggs, and livestock that are imported from other countries and inspects food processing plants. The USDA makes grading (quality) inspections for grain, vegetables, meat, poultry, eggs, milk, and other dairy products that are produced in the United States. The department also is involved in nutrition research and in educating the public about food and nutrition.

- *The United States Public Health Service* has no power to enforce laws, but it provides state and local governments with recommendations for establishing food ordinances. Its principle function is to help other agencies protect public health.

State and local governments have the responsibility of inspecting retail food establishments, restaurants, dairies, and grain mills. The FDA provides guidelines for state and local governments regarding restaurants and dairy products. State and local government laws may be more strict than federal laws but are never more lenient. State laws are responsible for governing food and food products produced and sold within the state.

◆ **Essential Questions:** ◆
U.S. Laws and Regulating Agencies

1. What are the laws that affect food safety and sanitation in the United States? Explain.
2. How does the Food and Drug Administration agency govern food safety?
3. What is the most current law affecting nutrition labeling? Describe.

FOOD STANDARDS OF CONTENT AND QUALITY

The FDA has the authority to determine food standards of identity, quality, and fill-of-container and to administer requirements of the Federal Food, Drug, and Cosmetic Act. There have been amendments in the law (1954 and 1958) since it was passed in 1938, but for the most part, the act has remained in its original form.

Standards of Identity

Definitions and standards of food products, called **standards of identity**, have been established to define the composition of the most commonly used food products such as butter and mayonnaise. However, because there are so many new products on the market combined with the existing products, standards have not been set for many products. Examples of standardized foods or foods that have standards of identity include most breads, ice creams, canned fruits and vegetables, and federally inspected meat and poultry products. A particular food product must meet the defined standard of identity before it can be called a certain product. An example of a standard of identity for mayonnaise is in Figure 9.6.

Standards of identity were enacted to provide consumers with protection from deceptions, sanitary controls, health safeguards, and required label statements. The establishment of health safeguards made it illegal to sell or attempt to sell food that is unsafe or a health hazard. Food containers also must be safe and free from any poisonous substance that might cause the food to become unsafe. Any color added to a product is under the same regulations. Any color additive must be approved by the FDA before it can be considered safe for use in any food product. Sanitary safeguards prohibit the sale of any food that is unclean, decomposed, or packed or held under unsanitary conditions because the food may have become contaminated, making it unsafe for human consumption.

The clause regarding food deception states that a food cannot be sold under any name other than its own. Food containers must provide accurate information about the amount of the contents in the container.

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Standard of Identity for Mayonnaise

Mayonnaise or mayonnaise dressing is the semisolid food prepared from:

- Vegetable oil(s)
- One or both of the following ingredients
 - any vinegar or any vinegar diluted with water
 - lemon juice and/or lime juice in any appropriate form, which may be diluted with water
- One or more of the following egg yolk containing ingredients: liquid egg yolk, frozen egg yolks, dried egg yolks, liquid whole eggs, frozen whole eggs, or dried whole eggs
- One or more of the following optional ingredients:
 - 1) salt
 - 2) sweeteners
 - 3) spice or natural flavoring
 - 4) monosodium glutamate
 - 5) preservative color and/ or flavor
 - 6) citric acid/or malic acid
 - 7) crystallization inhibitors

- All ingredients shall be safe and suitable.
- Mayonnaise contains not less than 65 percent vegetable oil.
- Mayonnaise may be mixed and packed in an atmosphere in which air is replaced in whole or in part by carbon dioxide or nitrogen.
- The name of the food is mayonnaise or mayonnaise dressing. Each of the ingredients used in the food shall be declared on the label as required.

Adapted from the Code of Federal Regulations, Title 21, Chapter I - FDASubchapter B, Part 169 as referenced in *The Almanac of the Canning, Freezing, Preserving Industries*, Seventy-third edition, Edward E. Judge & Sons, Inc. pages 322-323.

⇒ **Figure 9.6**

Food labels cannot contain any false or misleading information about the product. The information must be printed in English in a noticeable place on the package. The labels also must state the name and address of the product manufacturer and/or the packer or distributor and the accurate weight of the contents.

Standards of Quality

Standards of quality are the minimum requirements for the quality of food products. Characteristics with standards include color, tenderness, and freedom from defects (of canned foods). Mandatory standards of quality for certain food products are determined and enforced by the FDA. These standards are different from the voluntary standards for grading meat the USDA uses. USDA grades are used by both consumers and wholesalers to select cuts of meats. The standards of quality established by the FDA are used for wholesale trading purposes because the quality of the product affects the price of the product. If foods do not meet the standards of quality established by the FDA, the product must bear a label stating its quality. For example, a product might be labeled as Below Standard of Quality, Excessively Broken, or Excessive Peel. These labels are used primarily by wholesalers and are seldom seen by the consumer.

The United States Department of Commerce is responsible for the inspection and grading of fish and fish products. Fish and fish product inspection and grading are currently voluntary and available to the industry upon request for a fee. Fish products that meet federal regulations may be marked or stamped with the U.S. inspection seals along with the grade identification mark of the product. Quality grades include Grade A, B, and C, with Grade A being the best quality. Grade C is of good quality and of good nutritional value, but it is not as attractive in appearance as Grades B or A.

The USDA has two agencies that perform grading inspections. The Agricultural Marketing Service and the Federal Grain Inspection Service provide voluntary grading inspections and in some situations, mandatory inspections. The Federal Grain Inspection Service provides the mandatory grading services for most food and farm products. The exporters,

processors, or packers who request the service are charged a fee. The number of grades for each food product varies depending on the product's variability. There are three grades for turkey while there are eight grades for beef. The grades are continually reviewed and appraised by experts to assure their consistency with current market practices. The USDA grading standards for meat, poultry, milk products, and eggs follow.

Meat. The grading of beef does not indicate the nutritional value of the meat but represents two factors: yield and quality. Yield refers to the amount of edible lean meat available. Quality refers to probable tenderness and palatability (acceptability to the taste) of the cut of meat after the meat is cooked. An inspector grades the meat in the body or carcass form. There are basically eight grades of meat: Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner.

Prime grades are typically those used in restaurants and sold in meat markets. Choice grade and select grade are typically found in grocery stores. The meat from these three grades usually comes from well-fed animals that are less than two years old. The other grades are typically used in ground beef, canned meats, and sausages. Fewer grades are used for smaller animals such as the following:

- veal (young calf)
- lamb (young sheep)
- mutton (grown sheep)

Pork is graded in a similar manner to beef. Beef is graded by name (prime, choice, good) while pork is graded by number—U.S. No. 1, 2, 3, 4, or Utility—with the U.S. No. 1 being the top grade. The Utility grade is used in processed pork products such as canned pork mixtures and sandwich spreads.

Poultry. Poultry inspection is mandatory; however, grading is optional. Most reputable processors have their poultry graded, and it is

often done at the same time an inspection is done. The types of poultry that are graded include the following:

- chicken (common farm bird that is raised for eggs or its flesh)
- duck (small waterfowl with a short neck and legs, webbed feet, and a flat bill)
- goose (long-necked, webbed footed water fowl similar to a duck but larger)
- guinea fowl (member of a family of African birds characterized by a featherless head, round body, and dark feathers with white spots)
- squab (newly hatched pigeon)
- turkey (large, North American bird with a bald head and spreading tail bred for its flesh)
- Cornish game hen (special breed of young chicken, very tender and delicate)

Poultry grades are A, B, and C. Grade A is the best quality. The characteristics used for grading include the following:

- freedom from pinfeathers - The more pinfeathers (undeveloped feathers that are coarse and hairlike), the lower the grade.
- amount of fat on the bird - Some fat is needed but too much lowers the grade.
- shape of the bird - A well-proportioned, plump shape is best.
- number of disjointed or broken bones - Disjointed or broken bones lower the grade.
- number of cuts, tears, and other skin and flesh blemishes - The more blemishes there are, the lower the grade.

Milk. Fresh milk is graded according to its bacterial count or the amount of bacteria found in the milk. All milk has some bacteria. Grade A is the highest grade. Grade A has the lowest bacterial count of the three grades. Grades B and C are also safe and wholesome grades of milk. In most areas, only one grade of milk is sold based upon recommendations by the Public Health Service. The grade sold in one community may be different than the grade sold in another community.

Milk's New Names

Old Name	Possible New Names	Total Fat [per 240 milliliters (1 cup)]		Calories per 240 ml
		Grams	% Daily Value	
Milk	Milk	8.0g	12%	150
Low-fat 2 percent milk	Reduced-fat for less-fat milk	4.7g	7%	122
Not on the market	Light milk	4g or less	6% or less	116 or less
Low-fat 1 percent milk	Low-fat milk	2.6g	4%	92
Skim milk	Fat-free, skim, zero-fat, no-fat or non-fat milk	less than 0.5g	0%	90

Source: Kurtzweil, Paula. "Skimming The Milk Label." *FDA Consumer Magazine*. (January-February 1998).

Figure 9.7

Milk's new names designated by government standards of identity are included in Figure 9.7. Government standards for other dairy products also exist for various types of cream, butter, cheese, yogurt, and frozen desserts.

Eggs. Grades established for eggs have been divided into four categories. The grades are AA, A, B, and C. Grade AA is the best quality and due to its thick egg white the most satisfactory for poaching (cooked out of the shell in water or other liquid or in a small utensil over the water or liquid near the boiling point). It is also best for frying and cooking in the shell. Grade A eggs do not poach as well but are satisfactory for cooking and frying. The appearance of grade B eggs may be somewhat irregular both inside and

outside the shell, but the nutritive value is the same as the AA or A. Grade C eggs are usually not available for consumers to purchase.

Eighty percent of the eggs in a particular carton must meet the particular grade standard for which the carton is labeled. The other 20 percent allows for differences in storage and in inspection graders. Figure 9.8 identifies appropriate uses of each grade of eggs.

In addition to grades, eggs also are classified according to weight. The weight categories are determined by the minimum weight per dozen eggs. The classifications of weight are as follows:

- Jumbo 30 ounces per dozen
- Extra Large 27 ounces per dozen
- Large 24 ounces per dozen (most recipes are based on this size)

Appropriate Uses of Each Grade of Eggs

Grade	Use
AA	Poaching, frying
A	Baking, frying, hard cooking
B	Scrambled, omelettes, or in baked goods



Figure 9.8

- Medium 21 ounces per dozen
- Small 18 ounces per dozen
- Pee wee 15 ounces per dozen

The grade and size of eggs are marked on the egg carton. It is important to remember that although both size and quality are marked on the carton, one is not related to the other. Any size of eggs may be any grade.

Fill-of-Container

The standards of **fill-of-container** were established to help prevent misrepresentation of product packaging. The standards may vary from one product to another. Cereal and other solid foods must be filled to the maximum level of the container without crushing or breaking occurring. Many cereal boxes state that the contents may have settled during shipping or storage making the box appear to be less than full when opened. According to the USDA definition of fill-of-container, unless defined by FDA regulations, USDA grades recommend that cans be filled as full as possible without damaging the quality of the food product.

Essential Questions: Food Standards of Content and Quality

1. Why are standards of fill-of-container established?
2. How do egg grades differ from egg weights?
3. What two factors are involved in the grading of beef? Describe the grades.

LABORATORY EVALUATION METHODS FOR FOOD PRODUCTS

Laboratory evaluation methods for food products include physical and chemical properties. Various organizations set standards for evaluating food products and their functions. Examples of these organizations include the FDA, USDA, United States Public Health Service, National Marine and Fisheries Bureau of the United States, Department of Commerce, the FTC, and the Consumer Products Safety Commission.

Physical Properties

Physical properties refer to the principal physical characteristics of a substance or food determined by the senses. These characteristics can be affected by other substances. Physical properties of food include those that can be determined with the senses, such as color, flavor, smell, and texture, as well as the product's boiling and freezing points, solubility, fluidity, plasticity, and melting point. The physical properties of various foods have an effect on their preparation both at home and commercially.

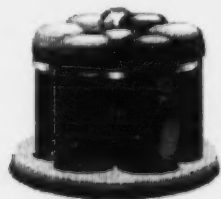
The sensory characteristics of food have a major influence on food consumption. The senses of sight, taste, smell, and touch serve

as evaluation tools for foods. Foods also can be evaluated by a combination of factors including flavor (smell and taste), texture (kinesthetics), and appearance (size, shape, and color). The following are characteristics that can be evaluated with the senses:

- **Color** - Color should be retained. Too much water or heat can dull the color of the product. Color is often added to foods to improve appearance.
- **Texture** - Texture refers to the way the food feels to the touch and in the mouth.
- **Flavor** - Flavor is a combination of smell and taste. Smell refers to the hundreds of aromas. Taste refers to the sensations of the taste buds on the tongue being either sweet, salty, sour, or bitter.
 - Sweetness (sugar) is perceived on the tip of the tongue.
 - Saltiness (table salt) is perceived on the tip of the tongue and on the roof of the mouth.
 - Sourness (lemon juice) is perceived on the tip of the tongue, sides of the tongue, and on the hard palate.
 - Bitterness (soda) is perceived toward the back of the tongue.

Several types of flavorings change or alter the original flavor of foods. Flavorings or flavor enhancers used include the following:

- monosodium glutamate
- extracts (liquid flavorings)
- herbs (parsley, basil, and oregano)
- spices (cinnamon, nutmeg, and pepper)



Monosodium glutamate is a flavor intensifier or enhancer that has little or no flavor of its own. It is high in sodium and should be used sparingly. Extracts are oils from aromatic plants stored in alcohol. The extract

Types of Herbs

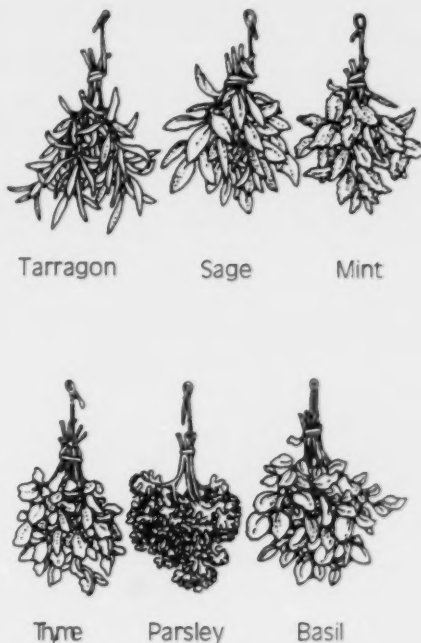


Figure 9.9

flavorings must be stored tightly covered to minimize the loss of the volatile flavoring compounds. Examples include peppermint extract, lemon extract, and vanilla extract. Spices and herbs come from various parts of certain tropical plants. Herbs come from the leaves of plants while spices come from various parts of the plants. Herbs also can be in the form of herb seeds. Figure 9.9 shows types of herbs.

The freezing point refers to the temperature at which water changes from a liquid form to a solid form. Different products may have different freezing points due to different water and ingredient concentrations. Salt water has a lower freezing point than fresh water. A salt solution has a lower freezing point than a sugar solution when both have

the same degree of concentration. In other words, the freezing point of a solution containing four cups of liquid and one cup of salt will be lower than the freezing point of a solution of four cups of liquid and one cup of sugar. The freezing point of sherbet is lower than that of ice cream because sherbet has a higher sugar content than ice cream.

The boiling point refers to the temperature at which water changes from a liquid to a gas. As with the freezing point, the boiling point depends on the ingredients of the product. For example, the higher the concentration of sugar in a product, the higher the boiling point will be. Heating a sugar solution until it boils is one way to determine the sugar concentration level of the product. Certain candies must have a certain concentration of sugar. The boiling temperature is a way to determine if the candy is done. The boiling point also is affected by altitude and barometric pressure. The higher the altitude, the lower the boiling point.

Solubility refers to the amount of a product that will dissolve in 100 grams of a liquid at a certain temperature to form a saturated solution. A saturated solution is one that has dissolved the maximum amount of a product that it normally can under a certain set of conditions.

Fluidity refers to a product's ability to flow or move without changing shape or separating. Water is very fluid, while molasses is much less fluid. The fluidity of water is much greater than the fluidity of molasses.

Plasticity refers to the ability of a product to change from one state to another or to be shaped, manipulated, or molded. Examples include the changes in cookie dough, pie crust, bread dough, and other yeast products. In fats, plasticity refers to the ability of the fat (such as shortening) to maintain its shape when exposed to slight pressure.

The melting point of a product refers to the temperature at which a solid substance turns into a liquid form. For example, fat melts to become oil. Different products have a particular melting point, and this melting point can be used as a means of identification. It is used often as a measure of purity because impurities, or substances not desired in a product, lower the melting point of a product.

Chemical Properties

Chemical reactions occur when two chemicals interact and the result is a change in both chemicals. **Chemical properties** refer to both the basic characteristic traits of a product and its chemical reactions when it is mixed with another product, heated, or frozen. Some of the chemical changes that take place when food is prepared include the following:

- hydrolysis of sugars and starches
- fermentation of carbohydrates
- cooking of starches
- browning
- rancidity
- hydrogenation
- coagulation
- effects of acids, bases, salt, and oxidation



Hydrolysis is a chemical process in which a substance reacts with water and is changed into one or more other substances. Examples include the breakdown of sucrose (table sugar) into a 50/50 mixture of glucose (blood sugar) and fructose (fruit sugar), the breakdown of lactose (milk sugar) into glucose and galactose (another milk sugar), or the breakdown of natural fats into glycerol (food fat) and fatty acids.

Fermentation refers to the process of yeast cells and bacteria transforming sugars into carbon dioxide and alcohol, which cause the volume of the dough to increase. It is used in doughs for bread, rolls, and cakes. The process of fermentation is influenced by

room temperature and the concentrations of sugar, salt, and yeast in the product.

Starches (carbohydrates) are cooked in order to obtain their full thickening capabilities and to develop flavor. Thickening is accomplished when enough water and heat is added to the starch granule for gelatinization to occur. Gelatinization refers to the process in which starch, water, and heat are combined causing the starch particles to absorb the water and swell. Gelatinization causes the starch to take on the appearance of thickening. Dry heat affects starches through the process of dextrinization. When starch or foods containing starch are heated with dry heat, dextrins are formed. The carbohydrate compounds formed, or dextrins, have a very sweet taste.

Browning enhances the color and flavor of foods. Browning can be caused by two factors: caramelization and the Maillard reaction. Caramelization occurs when any of the sugars are heated beyond their melting points. As the heat pulls the water out of the sugar, a series of reactions occur causing the sugar molecules to turn brown. The Maillard reaction occurs when an amino acid (protein) reacts with a sugar, such as lactose, maltose, or glucose, to produce a brown color. The Maillard reaction occurs during cooking as the temperature and cooking time increase. The Maillard reaction can occur in some foods at room temperature. The process occurs faster during the cooking process. The Maillard reaction can occur with dried milk that has been stored for a long period of time. The dried milk will begin to deteriorate and turn brown.

Rancidity is unique to fats and their spoilage. A fat is considered rancid when the flavor and odor have deteriorated due to exposure to heat or air.

Hydrogenation is the solidification of fluid oils and soft fats. Hydrogen added to unsaturated fatty acids causes them to become more saturated and to solidify.

Coagulation occurs when a substance changes from a fluid state to a thickened state due to the change in the protein of the substance. The change in the protein occurs through such processes as heat and the addition of acids or alkalies. Egg whites coagulate when exposed to heat by changing from a transparent mass to a soft white mass. Cheese is formed through the coagulation of protein in milk by lactic acid (milk sugar), bacteria, or certain enzymes.

Acids are compounds that have a strong, sour taste. Examples of acids include lemon juice, vinegar, and cream of tartar. Organic acids are composed of hydrogen, oxygen, and carbon and can be found in foods. Acetic acid gives vinegar its taste. Most vinegar is produced from ethyl alcohol using acetobacter bacteria to convert the alcohol to vinegar. Citric acid is found in citrus fruits; malic acid is found in pears, apples, and other fruits and vegetables; and tartaric acid is found in grapes. All colors in foods are intensified by the addition of acids. Acids added to cut fruits can slow the oxidation process or browning of the fruit.

Bases are compounds that can react with an acid and form a salt. In water, a base will have a bitter taste. Baking powder and baking soda are examples of bases. If bases are present in excess, they can change the white pigments of flour to a yellowish color and increase the Maillard reaction. To prevent this problem, bases are combined with acids in food production. Examples of foods containing acids that can be used in this process include buttermilk, yogurt, molasses, and brown sugar.

Effects of Acids and Bases on Vegetable Cookery

	<u>Food Source</u>	<u>Color</u>	<u>Texture</u>	<u>Nutritive Value</u>
Acids	Lemon juice, vinegar, cream of tartar	Intensifies all colors except green	Resists softening firm textures	Favorable to most nutrients except vitamin C—Vitamin C is more stable in oranges and tomatoes
Bases	Baking soda, baking powder	Dulls all colors except green	Softens cellulose	Increases destruction of thiamin and ascorbic acid

	<u>Peas (green)</u>	<u>Red cabbage (red)</u>	<u>Carrots (yellow)</u>	<u>Cauliflower (white)</u>
Acid	Dulls	Intensifies	Intensifies	Intensifies
Base	Intensifies	Dulls	Dulls	Yellows

Examples

≈ Table 9.2

Bases are used with acids as leavening agents in baked products such as breads. A leavening agent adds air to a mixture increasing the mixture's volume and lightness. Bases added to foods dull all food colors except green. Table 9.2 summarizes the effects of acids and bases in vegetable cookery.

Oxidation occurs when foods are exposed to air. Oxidation refers to the addition of oxygen and the reduction of hydrogen when a food product is exposed to air and results in food spoilage. When the surface of cut fruits and vegetables turns brown, it is a result of oxidation.

Salt is the only rock directly consumed by human beings. Salt has been used for centuries as a preservative for meats, poultry, and other products. Salt may be added to processed foods to prevent spoilage from bacteria, molds, fungi, and yeast. Salt used as a preservative also helps to extend the shelf life of the product and to protect the product's natural color and flavor.

◆ **Essential Questions:** ◆
**Laboratory Evaluation Methods
for Food Products**

1. What physical and chemical properties are used when setting standards for evaluating food products?
2. What are some of the chemical changes that take place when food is prepared?
3. What sensory characteristics of food have a major influence on food consumption?



Chapter Highlights

- ☆ Foods can become contaminated by adulteration, growth of microorganisms, or exposure to some form of environmental contaminant.
- ☆ The hazards of foodborne illness can be avoided by sanitary food handling and effective food preparation techniques.
- ☆ There are numerous food-regulating agencies in the United States that receive authority, power, and funding from food safety and sanitation laws. Some of these agencies are listed as follows:
 - Bureau of Alcohol, Tobacco, and Firearms
 - Centers for Disease Control
 - Environmental Protection Agency
 - Federal Trade Commission
 - Food and Drug Administration
 - National Marine Fishery
 - United States Department of Agriculture
 - United States Public Health Service
- ☆ Standards of identity have been established to define the composition of the most commonly used food products in the United States.
- ☆ Standards of quality are the minimum requirements for the quality of food products.
- ☆ Characteristics with standards include color, tenderness, and freedom from defects (of canned foods).
- ☆ Physical properties refer to the principle physical characteristics of a substance of food determined by the senses.
- ☆ Chemical properties refer to both the basic characteristic traits of a product and its chemical reactions when it is mixed with another product, heated, or frozen.

Chapter 10

Food Product Quality



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- S D Evaluate the effect of various temperatures, manipulative procedures, and leavening agents on food products.



Chapter Vocabulary

baking powder
baking soda
biscuit method
cake method
conduction
convection
convection oven
dry-heat cooking
methods

gluten
kneading
leavening agent
manipulation
mechanical mixing
moist-heat cooking methods
muffin method
yeast

The type of cooking method selected and length of time needed to cook any food depends on many factors. The composition of the food product, including the type, size, shape, and weight, must all be considered during the cooking process. The cooking method selected also adds variety and appetite appeal to foods. Many cooked foods are more appealing to the appetite than the raw product.

Cooking destroys harmful bacteria, organisms, and enzymes found in food items. At a cooking temperature of 185°F for ten minutes, nonspore organisms and bacteria are killed. When larger pieces of food are cooked, such as roasts, the heat does not penetrate as quickly. This makes it necessary to lengthen the cooking time to kill the harmful organisms. Acidic foods, such as tomatoes, peaches, and apples, do not require temperatures as

high as low-acidic foods. The high acid content in the food naturally inhibits the growth of harmful bacteria. Temperatures of 160°F are sufficient for cooking high-acidic foods to kill harmful organisms.

Storage is also an important part of food preparation. Proper storage protects nutrients from light, heat, air, and moisture. The different types of storage include refrigerator storage, freezer storage, and dry storage.

METHODS OF COOKING FOOD PRODUCTS

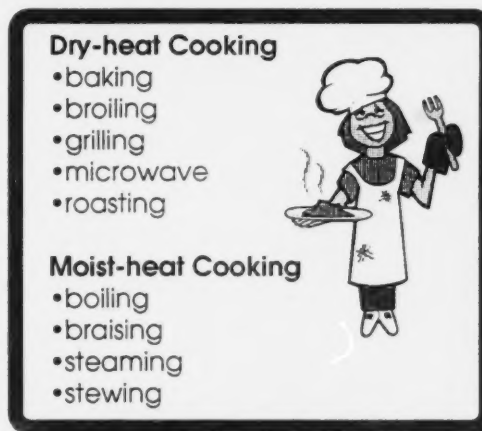
There are various methods for cooking foods. Each method has its advantages and disadvantages. Pressure steamers and pressure cookers use moist heat and high cooking temperatures but cook very quickly, thus balancing temperature with time. Steaming, stir-frying, pressure cooking, boiling, microwave cooking, broiling, grilling, and convection oven cooking methods retain a percentage of a food's texture, flavor, and color. If performed correctly, these methods allow for the retention of many nutrients.

The amount of time needed to cook food items depends on the temperature used, characteristics of the food item, amount of food, temperature of the food before cooking, and the speed of heat transfer of the chosen cooking method. Steam is a better conductor of heat than air. This is why it takes longer to bake a vegetable than to steam a vegetable. Convection ovens heat more thoroughly than conventional ovens because the forced air in the oven transfers heat rapidly. Cooking with convection ovens is faster than cooking with conventional ovens.

Special care must be taken when cooking vegetables and fruits. Heat, baking soda, and alkalies (such as egg whites) cause vegetables and fruits to soften. These elements break

down fiber substances that provide the structure and firmness of these foods. Alkalies cause nutrient loss and mushy textures when added to foods being cooked. Sugar helps keep fiber firm. Fruits cooked with sugar are more likely to stay firm and keep their shape.

Two cooking methods used in both commercial and home kitchens include dry-heat cooking methods and moist-heat cooking methods. **Dry-heat cooking methods** are cooking methods that surround food with hot, dry air. They include baking, roasting, and broiling. **Moist-heat cooking methods** are methods that use liquid to cook foods. Boiling, steaming, poaching, simmering, and braising are examples of cooking with moist heat. As much as possible, care should be taken during moist-heat cooking to prevent nutrient loss. Steam is an excellent method of moist-heat cooking because nutrient loss is minimal; foods maintain their shape and color and are cooked rapidly. Dry-heat and moist-heat cooking methods are listed in Figure 10.1.



⇒ Figure 10.1

Nutrients, flavor, and color can be lost in cooking. These can be preserved as much as possible by selecting appropriate cooking methods. To prevent nutrient loss and poor appearance, vegetables and fruits should be cooked carefully and for as little time as possible. Steaming is a good cooking method for

fruits and vegetables because it helps preserve natural qualities and nutrients better than most other cooking methods.

Steaming

Steaming is a cooking process in which food is cooked using steam as the conveyor of heat. The food is placed in a steaming rack that is held above boiling water. Steaming takes more time than boiling but allows the retention of more nutrients than boiling as long as the food is not overcooked. Because it is not in water, the product's original shape is retained.

The two types of steam cooking include normal and pressure generated steam cooking. In the normal method of steaming, the water does not touch the food and the container is not airtight. It is an excellent method for cooking vegetables because they retain their flavor, color, and nutritive value quite well. Steaming is fast but causes moisture to condense on the vegetables. Nutrients in the vegetables may dissolve into the moisture and become lost when the moisture drips off the vegetables. Steaming is used primarily for vegetables. Some meats are steamed over juices or broths that allow the meat to cook slowly, adding flavor from the juice or broth and leaving the meat tender and juicy. Meats and poultry are typically not cooked by the pressure steam method because the steam tends to overcook the meat and makes it less flavorful.

Pressure generated steam cooking, or pressure cooking, is a method in which steam is generated and contained in an airtight container that allows the steam and the internal temperature of the container to build up and cook the food. It is a fast method of cooking and is used often for cooking less tender cuts of meat, chicken, and vegetables. The high temperature and pressure result in a greater loss of nutrients and can change the color of green vegetables to a brownish-green color.

Stir-frying

Stir-frying is a method of cooking food quickly in a small amount of oil. It is a form of Chinese cooking similar to sautéing. The food is cooked quickly and can give vegetables a unique flavor. Stir-fried foods are often seasoned with soy sauce.

The food should be cut into small pieces, coated lightly with oil, and cooked in a wok or skillet with a small amount of water. A wok is a round metal skillet with tall sides. Food should be cooked until tender but not overdone.

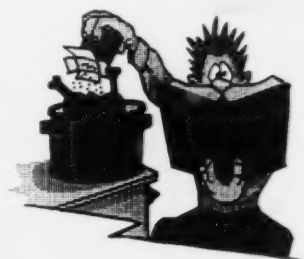
Boiling

Boiling is a fast method of cooking using water or other liquids at high temperatures. This method is common for cooking vegetables. The food is placed directly in the water or liquid and remains there until the cooking process is complete.

Boiling breaks up the structure of vegetables and causes nutrients to dissolve into the water. To maximize the retention of nutrients, taste, color, and

texture, food should be boiled in a covered saucepan with one-fourth cup of water per serving. To minimize cooking time and the length of exposure to high temperatures, the water or liquid should be brought to a boil before the food is added. After the food is added, the liquid should be allowed to come to a second boil. The heat source should then be turned down to facilitate a gentle boil rather than a rapid boil.

Many cuts of meat and poultry are boiled to prepare them from being served cold. The meat and poultry is covered in water and



simmered with appropriate spices and seasonings. The meat or poultry can later be cut in slices or cubes for sandwiches, salads, or casseroles.

Braising

Braising is cooking food in its own juices or with a small amount of added liquid. Braising is also known as fricasseeing. Braising requires use of low heat but a long cooking time. Again, nutrients could be lost because of the length of cooking time; however, the use of low heat helps to minimize the nutrient losses.

Braising is a moist-heat method of cooking, making it suitable for less-tender cuts of meat. Braising is used primarily for chicken and veal. Braising some veal cuts helps to soften connective tissue. It is also used for the flank in the beef hindquarter. Braising is recommended for the following types of meat:

- individual portions of meat, such as pork chops and Swiss steak
- chunks, cubes, or ground meat
- large cuts of meat, such as pot roast
- older chickens known as stewers
- beef brisket, chuck, plate, and shank
- picnic ham
- lamb shanks, necks, and shoulder
- variety meats

Broiling

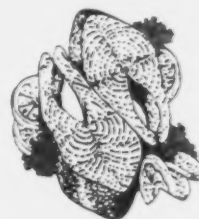
Broiling is cooking with direct heat from hot coals, a gas flame, or an electric element. The food is placed three to five inches below the heat source. Some nutrients, as well as fat, will drip away from meat that is broiled. It is easy to overcook meats that are broiled if one does not watch the cooking process closely. Broiling is good for high water content fruits and vegetables as well as tender and juicy cuts of meat.

Tomatoes are probably the most popular broiled vegetable. Thickly sliced or halved tomatoes may be topped with buttered

crumbs and broiled until brown. Some scalloped vegetables (vegetables cooked in a cream sauce) may be broiled for a short time to brown the tops.

Broiling meats with dry heat causes the juices to drip from the meat. These juices may contain nutrients that are lost. With the dry heat method there is also a danger of overcooking. Animal proteins are sensitive to heat. When they are broiled or cooked on outdoor grills, they can overcook quickly.

Broiling is a good way to cook fish. Fat fish (mullet, salmon, tuna, trout) broil better than lean fish (halibut) because they do not dry as easily as lean fish. Both types of fish should be oiled before they are broiled to maintain moistness. Oil should be used instead of butter because butter will burn.



Grilling

Grilling is done by placing food on a solid heating surface, on a surface with grids, or in a hot pan over heat. Food items typically grilled include ground meat, sausage, steaks, ham, thin pork chops, and bacon. Cooking foods on an outside grill with heat from charcoal or gas also is called grilling.

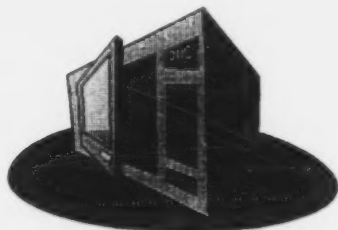
Smoked flavors, such as mesquite, hickory, oak, or cherry, can be added to foods that are grilled. Wet wood chips of the chosen flavor are placed on the charcoal grills. A gas grill cooks the food in similar manner to that of the charcoal. The burning gas heats ceramic reflectors or porous rocks that radiate the heat to the food.

Microwave Cooking

Microwaves are short, high frequency waves of energy that are created by a magnetron which converts electricity into

electromagnetic energy. Microwave cooking is done in a microwave oven that cooks with microwave energy. The microwaves generate heat by agitating the molecules inside the food. The majority of the heating of the food product occurs in the outer two centimeters of the product. The heat travels to the center of the food through a process called conduction.

The main advantage of cooking foods in a microwave oven is the amount of time that can be saved. Most foods can be cooked two to ten times faster in a microwave oven than in a conventional oven. It is a good method for cooking vegetables. The destruction of vitamin A is greater in microwave cooking than in boiling or steaming.



Water is very reactive to microwaves and rapidly converts to steam. It is necessary to puncture the skin or membranes of foods to allow the steam to escape. Pockets of water in foods may become very hot and explode. Puncturing the skin or membranes helps to alleviate the potential of a steam explosion. Each oven is different and adjustments in cooking time must be made accordingly.

Not all substances react to microwaves in the same way. Some microwaves are absorbed, some transferred, and some reflected. Foods that contain moisture and fat absorb the microwaves readily and become hot. Utensils used in the microwave must be able to transfer the microwaves rather than absorb or reflect them. Glass, paper, and some plastics do not absorb the microwaves, but transfer

them. These materials are suitable for microwave cookware because they transfer the microwaves to the food. Metals reflect the microwaves and block them from the food. The use of metal utensils can also cause a static electrical charge that causes sparks. The sparks formed can cause a fire if paper or plastic products are also being used. Therefore, standard pots and pans cannot be used in the microwave.

Fresh and frozen vegetables retain more nutrients when they are cooked in microwave ovens. The quality of vegetables cooked in the microwave depends upon the type of vegetable. Some vegetables retain more nutrients, color, flavor, and original texture than others. Spinach and broccoli are examples. As a whole, more nutrients and color are retained by vegetables cooked in the microwave oven than by those that are boiled; however, some vegetables may produce a more tough, fibrous texture as a result of microwave cooking.

Convection Oven Cooking

Convection ovens cook foods by using heated air and air circulation. A fan in the convection oven forces and circulates heated air within the oven producing faster cooking time at a lower temperature. Convection oven temperatures should be approximately 25°F to 50°F lower than the temperature needed in a conventional oven. A convection oven also provides a more uniformly cooked product than a conventional oven.

Altitude and Food Cookery

Most of the populated areas of the United States are located at altitudes of 3,000 feet above sea level or less. Therefore, most recipes are written for cooking at altitudes of 3,000 feet or less. Altitudes above 3,000 feet affect the way a product is prepared and cooked, requiring adjustments in recipes and methods of cooking. The higher the altitude, the thinner the air and the lower the atmospheric pressure. The lower atmospheric

Altitude	Temperature for the Boiling Point of Water
10,000 feet	192°F
7500 feet	197°F
5000 feet	202°F
2500 feet	207°F
sea level	212°F

⇒ **Figure 10.2**

pressure affects food cookery in two ways: liquids evaporate faster and boil at lower temperatures, and leavening gases in baked goods expand more.

Water boils at 212°F at sea level. With each 500 foot increase in altitude, the temperature needed for water to boil drops 1°F. This means that foods cooked in water or liquid at higher altitudes require longer cooking times. Even though the food is boiling, it is boiling at a lower temperature. Altitude levels of 5000 feet or more can cause cooking problems in the thickening of starch mixtures. Figure 10.2 represents the temperature of the boiling point of water at various altitude levels.

Since the air is thinner and pressure is lower at higher altitudes, leavened products, such as breads and cakes, rise faster. To counteract this problem, leavening agents and sugar are usually decreased while liquid ingredients are increased. The oven temperature also requires adjusting. Often, the temperature should be increased.

Guidelines to remember for high altitude cookery include the following:

- Use slightly less baking powder.
- Use more structure ingredients, such as flour.
- Add more water because water evaporates more readily.

Many food products, especially cake and muffin mixes, have altitude variation instructions on the product box. Several agencies and organizations can be helpful in making cooking adjustments for altitude variations. County extension agents for Family and Consumer Sciences are excellent sources of information on food issues.

◆ **Essential Questions:** ◆
Methods of Cooking Food Products

1. How does steam cooking affect the nutrients in vegetables?
2. How do animal proteins react to heat?
3. What are two examples of moist-heat cooking? Two examples of dry-heat cooking?

MANIPULATION OF FOOD PRODUCTS

Manipulation refers to the process of handling or treating a food product to develop a specific end result. Examples of manipulation procedures used on food products include mixing, beating, cutting, and cooking. Each procedure will result in a different effect on the food product.

Mixing and Kneading

Success in achieving a quality product not only involves the quality and proportion of the ingredients but also the method in which they are combined. In a flour mixture, the main goal is to evenly distribute the ingredients throughout the mixture. Mixing involves moving a spoon or similar utensil in a circular motion to combine the ingredients. Some products, such as muffins, require ingredients to be mixed only enough to be moistened



sible and to produce a batter that is smooth and creamy.

Gluten is a tough, sticky substance that is developed from wheat flour. Flour can be made from barley, buckwheat, corn, oats, rice, rye, and wheat, but only wheat has the right amounts of plant protein to develop gluten. Liquid must be added to these plant proteins for the gluten to begin forming. Gluten is formed by mixing the flour with a liquid and kneading or stirring. The mixture becomes elastic and sticky. The activation of the gluten allows the flour to stretch and hold the other ingredients, including gases, in a batter or dough form. The gluten is mixed to varying degrees depending on the product being created. The proper amount of mixing and manipulation of the gluten is extremely important to the final product.

Hand Mixing

Hand mixing involves moving a spoon or other similar utensil in a circular motion to distribute ingredients evenly. Muffin, biscuit, brownie, and pastry ingredients are mixed by the hand mixing method. This process introduces a small amount of air into the ingredients.

Two basic methods of hand mixing include the muffin method and the biscuit or pastry method. The **muffin method** requires mixing just until moist. It is described in Figure 10.3. Muffin batter should be lumpy. The muffin method is used for making muffins, popovers, waffles, pancakes, most corn breads, and some loaf breads. The ratio of

while others, such as cake batters, require ingredients to be mixed rapidly and for a longer period of time in order to incorporate as much air as possible

Muffin Method Procedure

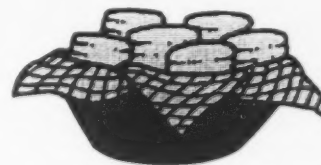
1. Sift dry ingredients together (flour, leavening, salt, and sugar) and add extra ingredients.
2. Mix liquid ingredients (eggs, milk, and melted or liquid fat).
3. Combine the liquid and dry ingredients by stirring only until the dry ingredients are moistened. The batter should appear lumpy.

➡ **Figure 10.3**

flour to liquid ingredients should be two to one.

Overmixing should be avoided but is easy to do with this method. Overmixing causes toughness, coarseness, tunnels, and peaks in the final product. The product will be less tender and may not brown properly.

The **biscuit method** or **pastry method** of mixing, described in Figure 10.4 results in a dry dough mixture used for biscuits or pastries. The ratio of flour to liquid ingredients should be three to one.



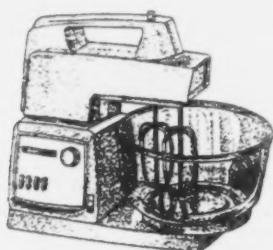
Kneading is a process used with yeast breads and is done by folding the dough and pressing it with the heels of the hands. The dough is rotated a quarter turn, folded, and kneaded again. Kneading distributes the ingredients more evenly and develops flakiness. Overkneading develops too much gluten and results in a tough, compact product.

Biscuit or Pastry Method

1. Sift dry ingredients (flour, leavening, and salt) and add extra ingredients.
2. Cut solid fat into the dry ingredients with a pastry blender (dough should resemble coarse cornmeal).
3. Add liquid ingredients.
4. Combine the liquid and dry ingredients and stir until all of the flour is moistened. Overmixing results in a tough product.
5. Place dough on a lightly floured board, knead ten to twenty times, roll out to one-half inch thick and cut as necessary.

⇒ Figure 10.4

Yeast breads can be made by three basic methods: the straight-dough method, the sponge-dough method, and the batter method. In the straight-dough method, all ingredients are combined and the dough is kneaded and set aside to rise. In the sponge-dough method, the yeast is combined with part of the liquid, flour, and sugar to make a batter. The batter is covered and allowed to rise in a warm place until light and bubbly. The remaining ingredients are added to make a stiff dough. In the batter method, the dough is mixed and shaped but not kneaded. After shaping, it is allowed to rise only a short time. The finished product has a coarse, porous texture and tends to dry out quickly.



Muffins, biscuits, and yeast breads are made by the hand mixing method. Sweet yeast breads are typically made by mechanical mixing.

Mechanical Mixing

Mechanical mixing involves a mechanical device, such as a hand-held mixer, table mixer, bench mixer, floor mixer, or blender that has an agitator, that moves in a circular motion to distribute ingredients of a product evenly. Mechanical mixing produces a more thoroughly mixed product than hand mixing. Hand mixing may produce a somewhat lumpy batter or dough while mechanical mixing produces a creamy batter or dough. The process typically introduces more air into the ingredients than hand mixing.

Mixers may be either hand held, floor models, bench models, or table models. The floor model mixer can hold thirty to sixty quarts and is used for mixing and blending ingredients or for adding air to a mixture. The bench model mixer can hold 12 to 20 quarts and the table model mixer can hold 5 quarts. These mixers are used for mixing, beating, or creaming ingredients for cakes, batters, doughs, and pastries. A hand-held mixer can be used to mix ingredients in almost any size container and is used more often in home cooking. The hand-held mixer is not as powerful as the other types of mixers and cannot introduce as much air into a product. All mixers can be used for mixing, creaming, or beating ingredients for cakes, batters, doughs, pastries, or meringues.

Mixers may have several operating speeds and may use a variety of beaters or agitators for specific purposes. A flat beater is used for general mixing. It is never used for heavy doughs. A wire whip is used for incorporating air into light mixtures but not for heavy mixtures. A dough hook is used for mixing heavy doughs that require a folding and stretching action. A pastry blade is used for combining

shortening and flour with a cutting action as for biscuits, pie crusts, or shortcakes.

Blenders are used for high-speed blending or mixing of meat, fish, vegetables, fruits, or beverages. Food processors are used to chop, slice, puree, and grate products at a high speed.

Sweet yeast breads can be mixed using the mechanical mixing methods. Sweet yeast breads include sweet rolls, doughnuts, and Danish pastries. The dough has a higher proportion of sugar, shortening, and eggs to flour. Sweet yeast breads are sweeter, more tender, and less chewy than other yeast breads. They are also mixed by a different method than other yeast doughs.

The shortening, sugar, salt, and flavorings are creamed or mixed together until fluffy. Liquid or dry solids are added and the mixture is creamed again. Eggs are added one at a time and beaten on medium speed. Yeast may be softened and added to the milk mixture, or dry yeast may be mixed with the last addition of flour. The flour is added gradually and mixed thoroughly on low speed after each addition. Danish pastries are not kneaded. A temperature of 78°F to 82°F must be maintained while mixing the dough because of the low gluten content. Too much mixing causes the temperature to rise and the dough to become sticky and difficult to handle. Proper mixing results in a smooth elastic dough.

The procedure for the conventional method or *cake method* of mixing is described in Figure 10.5. The conventional method of mixing should be used in all cake recipes unless the quick mix method is specifically recommended. The procedure for the quick method of mixing is described in Figure 10.6. The flour to liquid ratio in cakes should be two to one.

Conventional Cake Method

1. Cream fat, add sugar gradually, and cream until fluffy.
2. Add eggs and beat well until the mixture is well blended. If more than one egg is to be added, add the first egg and beat well, then add the other egg and beat well. If they are added all at once, it disturbs the emulsifiers (shortenings) and causes a coarse texture in the final product.
3. Alternately add the sifted dry ingredients and the liquid ingredients beginning with the dry ingredients. Beat well after the addition of each.
4. Pour the batter into a greased pan and bake at 350°F to 375°F.

Figure 10.5

Quick Cake Method

1. Combine the sifted dry ingredients, fat, and part of the liquid and beat at a high speed for two minutes.
2. Add eggs and the remaining liquid and beat for an additional two minutes.
3. Pour into a greased pan and bake.



Figure 10.6

Beating

Beating refers to the process of introducing air into a mixture or making it smooth by rapidly stirring the mixture with a spoon, beater, or whip.

Cutting

To conserve the maximum nutrients, vegetables should be cut in the largest pieces possible. Leaving as much skin in tact as possible also retains nutrients. Three ways to cut food include dicing, chopping, and slicing.

Dicing is a method of cutting food into cubes. Chopping refers to the process of cutting food with a sharp knife using an up-and-down motion resulting in small pieces of the food, either fine or coarse. Slicing refers to cutting the food either across or at an angle.

Cutting vegetables in small pieces shortens cooking time but exposes more surfaces to the cooking solution. Therefore, more nutrients can dissolve in the solution than if vegetables were cut in larger pieces.

The processes of canning, freezing, and dehydration also involve forms of manipulation that can affect the quality of the final food product. All fresh or raw foods are perishable. Processing slows deterioration so that the food can be eaten at a later date. Foods also are processed to improve flavor and digestibility, to kill harmful organisms and bacteria, and to provide convenience. Some processing techniques enhance the nutritional value of foods while others may decrease the nutritional value. Competition and marketing has encouraged food manufacturers to be creative and innovative which has led to the offering of products cut and prepared in numerous ways.

The Cooking Process

Food is cooked by the application of heat. Heat must be properly controlled to avoid excessive nutrient loss, shrinkage, overcoagulation (curdling) of protein, drying, and toughening. Foods are cooked to make them more digestible and appetizing. However, some fruits and vegetables eaten raw provide the most nutritional value. Foods are cooked to enhance flavor and digestibility; to improve appearance, color, and texture; to destroy harmful organisms and bacteria; and to provide variety.

Cooking is a chemical process that converts foods into a more digestible form. Heat applied to raw starch converts it to a softer, gelatinized product that is easier for the body to digest and convert into energy. Protein foods, such as meat and poultry, are tenderized by the cooking process. This makes them more palatable and digestible. Fish is cooked to develop flavor, appearance, and aroma. Cooking does not make fish more tender but coagulates the protein or flesh, changing it from a gray color to a white, flaky product. The cooking process converts the starches in products, such as noodles and breads, into dextrins and simple sugars that are more easily digested.

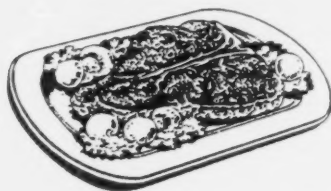


The appearance, texture, and color of cooked foods is an important factor. Fried foods are evaluated first by their texture and then by their color. An even, golden brown color represents a satisfactorily prepared product whether it is chicken, fish, or a fried pie. A chemical reaction during the frying process causes a browning effect on the surface of the product and results in a crispy, textured crust. The batter or cover that surrounds the food product is dehydrated during

the frying process. As the moisture evaporates, the crust becomes crisp. Some of the moisture is replaced with the fat. The fat tenderizes the crust and moistens it similar to the way butter moistens toast.

Preserving food color is an important factor in the cooking process. The bright color of English peas and the red color of beets makes them more appealing to the eye. When these foods and others are exposed to heat, the color is dulled. The longer food is exposed to heat, the greater the color loss. This explains the color difference in frozen sweet peas and canned sweet peas. The frozen peas are only exposed to heat and liquid for a short period of time while the canned peas are exposed to high heat for several minutes and are stored in liquid.

The size of food pieces also is important to appearance. Pieces of potatoes and meat in soups, stews, and casseroles should be large enough to be recognizable, small enough to be bite sized, but large enough to retain the maximum amount of nutrients possible.



Nutrient loss cannot be stopped completely. It will occur to cooked foods no matter how careful the cooking procedures. Some nutrients dissolve into the water or solutions in which foods are soaked, cleaned, or cooked. These nutrients are called water-soluble. This occurs primarily with vitamin C, the B vitamins, and minerals. When food is cooked in a solution, the heat makes the cell membranes in the food become more permeable. This allows the water-soluble nutrients to easily pass through the membranes and into

the cooking solution. Therefore it is important to use only a small amount of water when cooking fruits and vegetables.

Maximum nutrient retention can only be achieved if foods are cooked correctly. Overcooking or incorrect cooking results in the loss of valuable minerals and vitamins. There is a tendency to overcook certain foods such as vegetables and meats. Cooking the foods in too much liquid also results in nutrient loss. Overcooking vegetables results in nutrient loss, color loss, mushiness, and flavor loss or undesirable flavor. Overcooking meats results in shrinkage and drying, which makes the food unpalatable. To retain the maximum nutrients possible, vegetables should be cooked in minimum liquid for a minimum amount of time at minimum cooking temperatures, and the pieces should be as large as is practical. Figure 10.7 identifies suggestions for retaining water-soluble nutrients in foods.

Suggestions for Retaining Water-soluble Nutrients

- ✓ Avoid soaking foods.
- ✓ If soaking is necessary, use the same liquid when cooking the food.
- ✓ Do not discard juices from the food. About one-third of the nutrients of canned food is in the juices.
- ✓ Use juices for reheating foods or to make soups, stocks, sauces, and gravies.
- ✓ Use as little water as possible by using cooking methods that require less water.
- ✓ Reduce cooking times when appropriate.
- ✓ Cook vegetables only until they are tender and crisp.
- ✓ Cook with a covered utensil to reduce cooking time.

Figure 10.7

Heat Transfer

Heat is transferred from the source to the food in basically three ways: conduction, convection, and radiation. The transfer of heat requires that there be a difference of temperature between the heat source and the item to be heated. In cooking, the item to be heated is the food. Heat will flow to the item with the lower temperature.

Conduction is a process in which heat flows through solid matter by molecular transfer. Conduction is a direct transfer of heat. All matter contains molecules that are constantly in motion. The hotter the molecules become, the faster they move. The faster the molecules move, the more heat they generate. Different materials conduct heat at different rates. Some are better conductors of heat than others. Copper-clad stainless steel cooking utensils are very efficient heat conductors. Conduction is the heat transfer method used in conventional ovens.

When meat is roasted, heat currents flow toward the center of the meat. Once the cooking process is completed, the meat should be taken out of the oven and allowed to set for fifteen or twenty minutes before being cut. The internal juices will continue to circulate heat after being taken out of the oven. Allowing the meat to set for a few minutes enables the juices to continue the heating process and stop flowing naturally on their own. Slicing the meat too soon stops the natural flow of juices and causes the meat to lose color and natural juice, allowing the meat to become dry.

Heat is transferred in the **convection** method when hot air flows around and over the food. Convection, like conduction, is a direct transfer of heat. A convection oven has a fan that forces the air to circulate inside the oven, therefore decreasing the amount of cooking time. Another example of heat transfer through the convection method is cooking in hot fat. Hot fat circulates around the food

being cooked in a deep-fat fryer causing the food to cook more quickly than by other methods. Convection ovens are found in most restaurant and institutional kitchens and are becoming popular home appliances.

Unlike conduction and convection, radiation is not a direct transfer of heat. Radiation heats foods through the emission of invisible, infrared rays. The rays pass through the air and heat the surface of the food. The heat is absorbed and the internal heat is transferred by conduction. Microwave ovens heat food by this method. Nonionizing rays, or microwaves, are not dangerous. The other type, known as ionizing rays, cause chemical changes which have been linked to certain forms of cancer. Microwave ovens are safe and efficient appliances.

◆ **Essential Questions:** ◆ **Manipulation of Food Products**

1. How does processing affect the quality of the final food product?
2. How do the heat transfer methods of radiation and convection differ?
3. What is gluten and how is it formed?
4. How should vegetables be cut to retain maximum possible nutrients?

INGREDIENTS IN BAKED FOOD PRODUCTS

All bread products contain the same basic ingredients. These ingredients include flour, leavening agent, salt, fat, and liquid. In addition, some also contain eggs and sugar. Each ingredient contributes a special characteristic to the product. Figure 10.8 identifies the characteristics of these basic ingredients.

Characteristics of Basic Ingredients in Baked Goods

- *Flour* - provides structure
- *Liquid* - adds moisture (*Milk is more nutritious than water.*)
- *Leavening agent* - increases the volume of the product
- *Salt* - improves the flavor
- *Fat* - tenderizes
- *Eggs* - provides structure and some leavening
- *Sugar* - tenderizes, sweetens, browns

⇒ **Figure 10.8**

Breads are classified by the type of leavening agent used. Two types are quick breads and yeast breads. Quick breads are faster to prepare because they contain quick-acting leavening agents rather than yeast to make them rise and become light. Quick breads are leavened by baking powder, baking soda, air, or steam. These leavening agents act quickly so the product can be baked at once. Popular quick breads include muffins, corn bread, popovers, pancakes, waffles, pastries, and loaf breads.

Quick breads are basically mixtures of flour, liquid, and leavening. They may be classified by their proportion of flour to liquid. The more flour in proportion to the liquid, the thicker the mixture. Thin flour mixtures are called batters. Batters can be thin enough to pour or thick and sticky. Very thin batters are called pour batters. They contain about one cup of flour for each cup of liquid. Pancakes, waffles, and popovers are made from pour batters. Drop batters are too heavy to pour but too sticky to handle. They contain about two cups of flour for each cup

of liquid. Drop batters are used to make muffins, coffee cakes, and some biscuits and quick loaf breads.

Thick flour mixtures are called doughs. Soft doughs are stiff enough to handle and roll into shapes. The usual proportion is three cups of flour to each cup of liquid. Biscuits, doughnuts, and some coffee cakes are made from soft doughs.

Unleavened breads are also considered quick breads. Unleavened breads are made without the benefit of a leavening agent such as baking soda or yeast. Unleavened breads are made from a flour mixture, water, and sometimes salt and lard. Examples of unleavened breads are listed in Figure 10.9.

Yeast breads rise much more slowly than quick breads. Yeast breads contain yeast as the leavening agent. They have a pleasant and distinctive aroma, flavor, and texture. They may be made from white, whole wheat, or rye flour, or a mixture of all three. They may be plain or sweetened. Sweetened yeast breads include coffee cakes, sweet rolls, doughnuts, and Danish pastries. Yeast breads may be shaped into loaves or rolls. They may be baked in the oven or fried in deep fat. The crust may be hard or soft. A yeast dough forms the base for pizza.



Flour

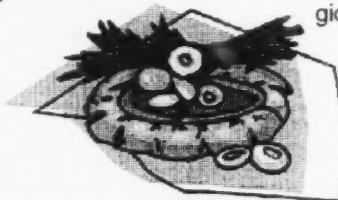
Flour is used in baked goods to form the structure or the body of the bread. Flour is rich in carbohydrates called starch. Enriched flour provides B vitamins and iron.

Unleavened Breads

Pita bread is also known as pocket bread. It originated in the Middle East. Pita bread is made from wheat and shaped into a round, thin form. The air pocket which forms during the baking process can be filled with lettuce, meat, or other foods to make a pocket sandwich.

Chapati is a flat, thin, unleavened bread which originated in India. Chapati is made from a mixture of water, salt, and a whole wheat flour called atta. Chapatis are baked in a hot, dry skillet.

Tortillas are flat bread which originated in Mexico. Corn tortillas are made from water and a special cornmeal rolled into a ball and pressed into a flat circle. They are cooked on both sides. Flour tortillas are made from unbleached flour, water, lard, and salt. They are kneaded, rolled into a circle and cooked on a griddle.



Injera is a soft, white unleavened bread from Ethiopia. Injera is made from teff—a grass containing small seeds. Teff is combined with water, shaped like a large pancake, and baked. It is torn into small pieces and used to pick up pieces of spicy food.

Matzo is an unleavened bread used in Jewish religious ceremonies.

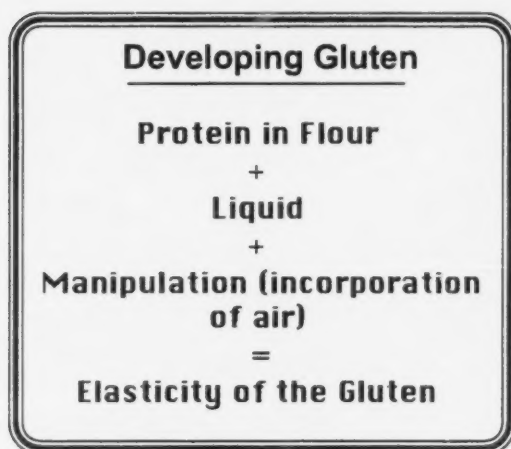
⇒ Figure 10.9

All-purpose flour purchased in stores is made from wheat. It is more refined than whole wheat flour. The two types of wheat flours are hard and soft. Soft wheat flours produce a softer gluten than hard wheat flours. Soft wheat flours are used for cakes while hard wheat flours are used for breads. All-purpose flour is made from a blend of both hard and soft wheats.

Whole wheat, graham, rye, and other specialty flours add flavor and variety to breads. Meals, like cornmeal and oatmeal, are used to add texture and flavor to some breads. These meals and specialty flours do not have enough gluten to develop a desirable bread structure. They should be combined with white wheat flour to ensure an adequately leavened product.

Many recipes call for the use of sifted flour. Flour can be purchased already sifted or it can be sifted prior to being mixed with other ingredients. Sifting the flour affects the amount of volume or air that can be incorporated into the product. Several types of flour are available on the market today. Each has a different percentage of protein. The protein in the flour determines the structure of the baked good.

The amount of liquid used affects the gluten development in the product. In dry mixtures, the gluten does not develop completely. Many cookie doughs and pie doughs are somewhat dry for this reason. If too much liquid is added to the dough, it dilutes the gluten and keeps it from sticking together. Gluten develops best in a mixture that enables it to stick together. Figure 10.10



⇒ Figure 10.10

contains the formula for developing gluten. No amounts are listed because different products require different amounts of the ingredients. For example, cakes require more protein in the flour, more liquid, and more manipulation than cookies.

During cooking, the carbon dioxide gas expands and increases the volume of the product. As this takes place, the protein coagulates and the rigid framework or crust of the product is formed. The more protein in the flour, the stronger the structure. Stronger protein or a higher percentage of protein absorbs more water. High-protein flour needed for breads absorbs more water than low-protein flour used for cakes and cookies. Types of flour and protein content include the following:

- bread flour 13 percent
- all-purpose enriched flour 11 percent
- cake flour 8 percent
- whole wheat flour 14 percent
- self-rising flour 10 percent
(all-purpose flour with a leavening agent and salt)

Liquid

The liquid used most often in baked goods is milk. Buttermilk or sour milk and fruit juices are also used. The liquid dissolves the dry ingredients including the chemical leavening agents. The liquid also provides some of the leavening action when the liquid is converted into steam during the cooking process.

Using water as the liquid ingredient makes the texture of the bread coarse and chewy. It makes the crust crisp. Water is used for French and Italian bread and hard rolls.

When milk is used as the liquid, it adds to the flavor, color, texture, and browning characteristics of the product. The milk gives the bread a velvety grain. Milk also adds minerals, vitamin D (calciferol), and some complete protein to the product's nutritional value.

Leavening Agents

To leaven means to make a food light and porous by adding air and making the product rise. A **leavening agent** refers to air, steam, or a chemical reaction activated by another ingredient that produces carbon dioxide in a batter or dough. Carbon dioxide makes the mixture rise, become light and porous, or increase in volume. Carbon dioxide is a harmless gas that when heated causes the mixture to expand and rise.

Leavening agents are used to make baked goods rise. Leavening agents used may be chemical (baking powder or baking soda), yeast, air, or steam. Only a small amount of leavening agent is needed. Too much causes a coarse product that dries out easily. Too little leavening results in a product with a fine grain, small volume, and a rough crust. Leavening adds no nutritive value to the food product.

Salt

Salt improves the flavor of breads and strengthens the gluten. Salt keeps the yeast from growing too fast and is essential for satisfactory yeast products. It improves the texture, color, and keeping quality of the bread. Too much salt results in a firm, compact product. Salt adds no nutritive value to the product.

Fat

Fat or shortening is the ingredient that gives baked goods their tenderness. The fat used may be shortening, lard, margarine, butter, or oil. Vegetable shortening and lard can be used but have a relatively bland flavor. Butter or margarine gives baked products a pleasing flavor. The fat also increases the product's caloric value. Too much fat slows the action of yeast.

Eggs

Eggs in baked goods contribute to color, texture, and nutritive value. Eggs are rich sources of nutrients including vitamins, minerals, and some complete protein. When air is beaten into eggs, the eggs act as a leavening agent. When air is beaten into egg whites, a foam is formed. The egg white surrounds the air bubbles in the foam. Egg white foams are used to leaven puffy omelets, soufflés, meringues, angel food cakes, and other foods. The air in the egg white foam expands when heated. This causes the product to increase in volume until the heat thickens the egg protein surrounding the air bubble. This makes the product light and porous.

Low temperatures are used to delay coagulation of the egg white and allow as much time as possible for the air to expand. The thinner the viscosity (solidity or thickness) of the egg white, the more it will stretch to hold more air. Egg whites at room temperature have a thinner viscosity than cold ones. Egg whites at room temperature will add more leavening power to a product.

Eggs are used as the primary leavening agent in the following food items:

- angel food cake
- chiffon cakes
- sponge cakes
- soufflés
- meringue

To ensure that as much air is beaten into the egg whites as possible, the following guidelines should be observed:

- Bring the egg whites to room temperature before beating.
- Avoid exposing the egg whites to fat (fat from the egg yolk, milk, or a greasy bowl or beater reduces the amount of air which can be beaten into the egg whites).
- Select the smallest suitable bowl with a small rounded bottom and sides that slope out to a wider top.
- To increase the stability of the foam, add cream of tartar to thicken whites and add sugar gradually after the whites reach the soft-peak stage.

The type of product desired determines the stiffness to which the egg white is beaten. The egg whites are suitable for folding into mixtures when the peak will just bend over as the beater is slowly lifted out of the foam. This soft-peak state also is used for the soft meringues used on cream pies. Additional beating causes the peak to stand up straight as the beater is lifted. Hard meringues are beaten to the stiff-peak stage. Hard meringues may be shaped into meringue shells or cookies and baked at a low temperature (250°F).

Beaten egg yolks or whole eggs help to leaven baked products that contain other leavening agents besides air. They also add moisture to form steam, adding to the leavening action. Eggs provide part of the leavening for butter cakes, muffins, and other quick breads.

Sugar

Many baked products contain sugar or syrup. Sugar in baked goods is added for its sweet flavor, tenderizing qualities, and browning capabilities. Sugar also adds to the caloric value of the food product. It helps baked products stay fresh longer. When sugar is added to a batter or dough containing yeast, it serves as food for the yeast, allowing the bacteria to grow and multiply. Too much sugar, however, may slow the action of the yeast.

The sugar used in baking may be purchased in several forms including the following:

- granulated
- brown
- powdered
- syrups, such as molasses, malt syrup, honey, corn syrup, and maple syrup

◆ Essential Questions: ◆ Ingredients in Baked Food Products

1. What are the seven basic ingredients of baked products? What are their functions?
2. What factors affect the amount of volume incorporated for leavening through physical means or manipulation?

FORMS OF LEAVENING AGENTS

Air and steam leaven all flour mixtures to some extent, but a leavening agent is added to the mixture to cause the expansion of the carbon dioxide gas during heating. The leavening agents may be incorporated in the batter or dough by either chemical or physical means. The type of leavening agent used to

produce the gas and the amount of time required to form the gas determine the texture and other characteristics of the leavened product.

Air

Air is incorporated into a batter or dough through physical means. Air serves as a leavening agent when it is beaten or folded into a mixture through the process of beating, sifting, or creaming a product's ingredients. Air partially contributes to the volume of the leavened product. The amount of air or volume is determined by physical means or manipulation. The actual leavening process of air takes place during the heating process. Factors that affect the amount of volume incorporated through manipulation are identified as follows:

- amount of creaming
- number of times the flour is sifted
- type of shortening used
- temperature of the batter or dough
- size, grade, and number of eggs used
- mixing speed
- size of the sugar crystals
- type of mixing utensil - whether batter is mixed by hand or mixed by machine
- size of the mixing bowl in relation to the amount of batter or dough

Steam

Water turns into steam as it is heated. The water in dough or batter changes to steam as it is heated and acts as a leavening agent. Some products rely totally on steam as a leavening agent. These products are baked at higher temperatures than products using other leavening agents. Examples of products with steam as the primary leavening agent include cream puffs, pastries, doughnuts, and popovers.

Chemical Agents

Chemical leavening agents are chemicals that react with moisture and heat to form carbon dioxide. Chemical leavening agents

are used in quick breads because they react quickly. Baking soda and baking powder are the two types of chemical leavening agents.

Baking Soda. *Baking soda* is used with some types of acidic food to produce the leavening power. The baking soda neutralizes the acid. Acidic foods include buttermilk, sour milk, sour cream, yogurt, molasses, corn syrup, honey, and chocolate. Honey, chocolate, and corn syrup have low acidity levels and cannot be used as the only source of acid in a recipe. The acidity levels of sour milk and molasses may vary with age and degree of sourness. When the baking soda and the acidic solution are mixed, carbon dioxide is formed.

The carbon dioxide reaction is immediate when the leavening agent and the acidic ingredient are mixed together. Baking soda should be mixed with the dry ingredients before being exposed to the acid ingredient. Proper amounts of baking soda in a recipe are very important. Too much baking soda causes an undesirable flavor and color and also destroys nutrients, especially thiamin.

Baking Powder. *Baking powder* is a combination of baking soda, dry acid or acid salts like cream of tartar, and flour or starch. Flour or starch is added to stabilize the mixture and keep it from clumping. Mixing the baking powder with a liquid causes the acid salt to dissolve and react with the soda, enabling carbon dioxide to form and leaven the product. It is used most often in quick breads. Baking powders absorb moisture while in storage and eventually lose their strength or potency. They should be purchased in small quantities and used within a reasonable length of time.

To test the leavening power or freshness of baking powder, mix one teaspoon of the baking powder with $1/3$ cup of hot water. If the reaction is a bubbly mixture, the baking powder is still good.

Baking powders are classified based on their acid components. The three types of baking powders are the following:

- phosphate
- sodium aluminum sulfate (SAS)
- tartrate



The type of acid the baking powder contains determines how quickly the carbon dioxide is formed.

Phosphate baking powders contain monocalcium phosphate or monosodium phosphate. Some contain cream of tartar. Approximately two-thirds of the carbon dioxide is produced after it is combined with a liquid. The remaining one-third is produced during the cooking process. A bitter taste results if too much phosphate is added.

Sodium aluminum sulfate (SAS) are phosphate powders with acid ingredients of calcium acid phosphate or sodium aluminum sulfate. SAS releases the greatest amount of carbon dioxide when the mixture is heated. SAS is the baking powder most often sold in the grocery store.

The active ingredient in tartrate powders is baking soda, tartaric acid, and cream of tartar or potassium acid tartrate. Tartrate baking powders react instantly when mixed with a liquid. The batter or dough must be baked quickly after mixing. Tartrate baking powders are seldom used in the United States.

Baking powders also are classified according to their reaction. Powders may be single-action or double-action baking powders. Single-action baking powders release carbon dioxide as soon as moisture is added. This is because the acid is soluble in cold water. The action speeds up when heat is applied. Because it acts so quickly, the product must be

mixed, prepared for baking, and placed in the oven quickly. All tartrate and some phosphate baking powders (those containing cream of tartar) are single-action baking powders. These powders are relatively expensive and are no longer marketed in the United States. The equivalent of one teaspoon of a single-action baking powder can be made with one-half teaspoon of cream of tartar and one-fourth teaspoon of baking soda. One-fourth teaspoon of cornstarch should be added if the mixture must be stored.

Double-action baking powders require both moisture and heat to completely release all carbon dioxide. They contain a base (baking soda) and two types of acid powders—usually monocalcium phosphate and sodium aluminum sulfate (SAS). The phosphate powder can be sodium acid pyrophosphate or calcium acid phosphate or a combination of the two. The phosphate powder is soluble in cold water while the SAS powder is only soluble in hot water. Phosphate powder acts much more slowly than single-action baking powder. It releases some carbon dioxide before the mixture is heated but releases most when heat is applied. All SAS baking powders are double-action baking powders. Some phosphate powders require double action.

Commercial bakers have access to a variety of leavening agents. Special leavening agents are needed for the great variety of baked goods, frozen batters and doughs, and packaged mixes produced and marketed today.

Baking powder used in recipes must be accurately measured. Using too much baking powder causes too much carbon dioxide to be produced. Too much carbon dioxide causes the product to collapse. Using less than the amount specified does not create enough carbon dioxide for adequate leavening and results in a small, compact product. Occasionally, a recipe may specify using both baking powder and baking soda. This means that an

insufficient amount of carbon dioxide will be produced from the soda and acid to leaven the product. Baking powder must also be used to provide enough carbon dioxide to leaven the product sufficiently.

Yeast

Carbon dioxide also can be formed from the combination of yeast and sugar. Bacteria cells grow through a process called fission. Cells grow or bud from other cells. This is called budding. When the yeast is exposed to a certain temperature, moisture, and food, carbon dioxide is produced. Sugar is a substrate or food for yeast. The food is in the form of simple sugars from starch, granulated sugar, or both.

Yeast feeds on starch and sugar. It grows best at temperatures between 78°F and 85°F. The yeast dies at temperatures above 140°F. Yeast grows in a moist environment with adequate food and the correct temperature. It produces carbon dioxide which slowly stretches the dough and causes it to rise. This process takes several hours.

Yeast is available in two forms: compressed yeast and active dry yeast. Compressed yeast is in an active state. Compressed yeast also is known as fresh yeast or cake yeast. It is packaged as a moist mixture of the yeast and starch or sugar. Compressed yeast keeps for four or five weeks in the refrigerator. It spoils quickly if exposed to temperatures above 60°F.

Active dry yeast has basically the same ingredients as the compressed yeast only it has been dried and packaged in a granular form. The sealed envelope packaging is dated to ensure freshness. It does not require refrigeration but should be stored on a shelf in a cool, dry area. Making yeast breads involves ten basic steps. Each step is described in Figure 10.11.

Making Yeast Breads

1. **Measuring.** Be accurate.
2. **Mixing.** Use the straight-dough method, sponge-dough method, or batter method to combine the ingredients and develop the strength of the gluten.
3. **Kneading.** Fold, press, and squeeze the dough to develop the strength of the gluten.
4. **Fermenting.** Carbon dioxide is formed in this stage. Allow the dough to rise in a warm place (80°F to 85°F) until double in size.
5. **Punching.** Fold the dough from the sides to the middle and press to expel the gas bubbles and remix the ingredients so the yeast can grow again.
6. **Resting.** Allow the dough to relax for ten to fifteen minutes to make it easier to handle.
7. **Makeup.** Prepare the dough for baking by scaling, rounding, and shaping. **Scale** or divide the dough into sections. **Round** each section into a smooth mound and allow it to rest for 10 minutes. **Shape** the dough into loaves or rolls.
8. **Panning.** Place the dough in the pans for baking.
9. **Proofing.** Allow the dough to rise a final time before baking. A temperature of 100°F and a humidity level of 80 to 85 percent are ideal for the rising dough.
10. **Baking.** Cook the dough in the oven to kill the yeast, harden the gluten, and brown the sides and the top.

≈ Figure 10.11

Air is a major component of the structure of yeast doughs. Air allows the dough to maintain its shape. This makes yeast doughs fragile. Pans of dough must be handled carefully to prevent damage to the structure of the dough. If the structure is damaged, it may collapse. Once transferred to an oven safely, the heat of the oven speeds the growth of the yeast for the first fifteen minutes. Then, the gluten and starch begin to coagulate, making the product firm. The sugar in the dough causes the crust to brown and become glossy or bloom.

Important points to remember when making yeast breads include the following:

- Measure ingredients carefully.
- Too much sugar or salt will interfere with the development of the gluten.
- Too much flour will make the dough too stiff.
- A temperature that is too hot will destroy the yeast.
- A temperature that is too cold will slow the growth and action of the yeast.
- Dough should be kneaded sufficiently to develop the gluten with enough elasticity and strength to retain the carbon dioxide.

Causes of failure in yeast breads are listed in Figure 10.12.

Causes of Failure in Yeast Breads

- Poor volume results from adding liquid that is too hot and kills yeast.
- Insufficient kneading results in a product with poor volume.
- Omitting sugar will result in a product with poor volume.
- Insufficient rising will result in a compact, less tender product with poor volume.
- Too much rising will result in a product that is coarse and sour.

≈ Figure 10.12

Another form of yeast bread is a sourdough bread. It is made with a leavening agent called a sourdough starter. The starter is a mixture of flour, yeast, and water. The mixture is fed weekly with a sugar and or potato water mixture. The mixture is kept alive by the weekly feedings and refrigeration.

◆ **Essential Questions:** ◆
Forms of Leavening Agents

1. How are baking powders classified?
2. What type of baking powder is the most commonly used in the U.S.?

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Chapter Highlights

- ☆ The type of cooking method selected and length of time needed to cook any food depends on many factors including the type, size, shape, and weight of the food product.
- ☆ Dry-heat cooking methods are cooking methods that surround food with hot, dry air. They include baking, roasting, and broiling.
- ☆ Moist-heat cooking methods are methods that use liquid to cook foods. Boiling, steaming, poaching, simmering, and braising are examples of cooking with moist heat.
- ☆ The main advantage of cooking foods in a microwave oven is the amount of time that can be saved. Most foods can be cooked two to ten times faster in a microwave oven than in a conventional oven.
- ☆ Success in achieving a quality product not only involves the quality and proportions of the ingredients but also the method in which they are combined.
- ☆ To cook foods properly, heat must be controlled to avoid excessive nutrient loss, meat shrinkage, and over-coagulation of protein, drying, and toughening.
- ☆ A leavening agent refers to air, steam, or a chemical reaction activated by another ingredient that produces carbon dioxide in a batter or dough. Carbon dioxide makes the mixture rise, become light and porous, or increase in volume.
- ☆ The type of leavening agent used to produce the gas and the amount of time required to form the gas determine the texture and the other characteristics of the leavened product.
- ☆ Maximum nutrient retention can only be achieved if foods are cooked correctly.
- ☆ Breads are classified by the type of leavening agent used. They are either quick breads or yeast breads.
- ☆ The amount of time needed to cook a food item depends on the temperature used, characteristics of the food item, amount of food, temperature of the food before cooking, and the speed of heat transfer characteristics of the chosen cooking method.
- ☆ Two cooking methods used in both commercial and home kitchens include dry-heat cooking methods and moist-heat cooking methods.

Chapter 11

Cooking Utensils and Equipment



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

3C Compare the effects of various cooking utensils and equipment on food products.



Chapter Vocabulary

anodizing aluminum
arcing
cast iron
nonstick finishes
copper

enamelware
hot spots
seasoning
stainless steel
kitchen shears

THE SCIENCE OF MATERIALS USED FOR COOKING EQUIPMENT AND UTENSILS

Characteristics of Materials

The quality of bakeware and cookware is measured by their ability to conduct heat evenly, clean easily, and remain durable. The finish on the outside of the bakeware affects how the final baked product will look. A shiny finish reflects heat while a dark finish absorbs heat. A product baked in bakeware with a shiny finish has a light-colored crust while one baked in bakeware with a dull or dark finish has a darker, crispier crust. Figure 11.1

describes factors to consider when selecting bakeware.

Good quality cooking utensils distribute heat evenly and allow food to cook evenly. If hot spots develop, the utensil is not considered to be of good quality. **Hot spots** occur when the utensil becomes hotter in one area than in another, making the food heat unevenly. The heat may scorch the food. The type and thickness of metal from which a pot or pan is made affects uniform cooking.

Factors to Consider When Selecting Bakeware

- Flat surfaces provide the best contact with the heat source.
- Knobs and handles should be heat resistant.
- Thick metals are less likely to warp and dent than thin metals.

→ **Figure 11.1**

Cast Iron

Cast iron is the traditional material used for cookware and bakeware. It is heavy, durable, heats slowly, yet holds and conducts heat very well. It has a textured surface that enables it to hold oil. The oil helps to keep food from sticking to the utensil. Iron can rust, retain certain food odors, and discolor some acidic foods. Cast iron must be seasoned to keep foods from sticking and to avoid rusting.

Seasoning a cast iron piece involves wiping it with oil and heating it in the oven. It should be washed by hand in hot detergent water, wiped dry with a clean towel, and dried completely in a warm oven. Cast iron should never be scoured because the process removes the oil needed for seasoning.

Aluminum

Prior to World War I, iron was the primary material used for making pots and pans. Advances in science and technology led to the development and use of other products for cookware and bakeware. Aluminum is very popular for both cookware and bakeware and is a good conductor of heat, spreading it quickly and evenly. Cast aluminum is heavier and is used for utensils such as skillets. Sheet aluminum is lighter in weight and is used for items such as cookie sheets. As with other cooking materials, the thicker the product, the more durable it is.

Aluminum is a good conductor of heat, but it should not be used for storing food or for cooking foods for a long time. High-acid foods may cause chemical reactions to occur. Food acids cause metals to become soluble. The longer acidic foods remain in contact with the metal, the more the metal dissolves. Some dissolving metals contaminate food and should never be used to contain foods. These metals include copper, galvanized metal, the metal base of chipped enameled pans, brass, and cadmium.

Untreated aluminum surfaces stain or darken when they come in contact with certain foods. The same problem can occur when an aluminum utensil is washed in a dishwasher. When aluminum is used with alkaline foods or those with pH levels above 7, such as milk and other dairy products, it can discolor and pit. **Anodizing aluminium** refers to the process of putting a protective, often colored, oxide (light metal) film on the utensil surface. Anodized surfaces provide better wear and are better conductors of heat than polished, shiny surfaces.

Copper

Copper is a very good conductor of heat, but it can be expensive. Pure copper cannot be used alone for cooking because it reacts with certain foods, causing poisonous compounds. It is often applied to the bottoms of other types of cookware, such as copper-clad stainless steel pots and pans. Copper discolors and must be polished often to remove tarnish. Copper cookware items are usually lined with a thin layer of chrome, stainless steel, or tin. Great care should be taken when cleaning this lining. If the copper is exposed, the utensil may become dangerous to use.

Clear Glass

Utensils made of glass do not react to food colors or flavors. Glass absorbs heat quickly and holds it well. Glass is very sensitive to sudden changes in temperature,

however, and can break easily. Glass is not a good conductor of heat (able to transfer hot to cold), and it cracks, breaks, and chips easily. Glass is not used in commercial food preparation because of the potential for breakage.

Enamelware

Enamelware is made by a process that fuses or melts several layers of a glass-like material on an iron base. It is very resistant to acidic foods because of the layers of baked-on enamel. Enamelware absorbs and holds heat well, does not discolor food, does not affect the taste of food, is easy to clean (unless food is allowed to burn), and is available in a variety of colors. Metal utensils, such as spoons, can damage the surface of the piece. Enamelware can chip when dropped or exposed to sudden temperature changes.

Glass-ceramic

Glass-ceramic or opaque glass bakeware is a very durable product that can withstand high temperatures without breaking. It can be taken from freezer to oven to dishwasher without difficulty. It is a slow conductor of heat and may have hot spots. Glass-ceramic bakeware performs best in low to moderate temperatures.

Stainless Steel

Stainless steel is an alloy or mixture of nickel, steel, and chromium. It is used for cookware and bakeware; however, stainless steel is not the best material for bakeware such as cake pans and cookie sheets. Stainless steel is very durable, stain resistant, easy to clean, and does not discolor foods. It is a poor conductor of heat and tends to scorch foods easily when used alone for bakeware and cookware. It is usually combined or clad with other products, such as copper and aluminum, to increase its heat distribution capabilities. It is a slow conductor of heat, but once heated, stainless does hold heat well. Stainless steel is excellent for storing foods

because it does not react chemically with foods as other metals do. Stainless can be expensive and shows water spots easily.

Plastic and Other Materials Safe for Use in the Microwave Oven

Plastic utensils have gained popularity and quality with the increased use of microwave ovens. Plastic utensils are resistant to stains, easy to clean, and safe in the dishwasher and microwave ovens. Many also can be used in the freezer. Depending on the plastic, some utensils can be used in the oven while others cannot withstand temperatures above 400°F.

Utensils other than plastic can be used in the microwave oven. If a person is not sure of the safety of a particular utensil in the microwave oven, a simple experiment can be conducted. A person can pour approximately one-half cup of water in the dish, place it in the microwave oven, and cook on the highest temperature for one minute. If the water is warm and the dish is still cool, the dish is safe to use in the microwave oven. If the dish is hot and the water is cool, the dish is not recommended for use in a microwave oven.

Metal utensils reflect the microwaves (waves that generate heat by agitating molecules inside food) away from the food in the container, hence slowing the cooking process. Using metal utensils in a microwave oven can cause a sparking or lightening effect. This effect is called **arcing**. Arcing can permanently damage the microwave oven. Table 11.1 identifies items that are safe or unsafe for use in the microwave oven.

Nonstick Finishes

Nonstick finishes on preparation, cooking, and baking utensils provide surfaces that help keep food from sticking to the utensil. The substance used in the finish is fluorocarbon resin. The nonstick finish also makes it easier to clean the utensil. Teflon™ is a

Safe for Microwave Use	Unsafe for Microwave Use
✓ glass ✓ paper ✓ earthenware ✓ dishwasher-safe plastics ✓ microwave oven cookware ✓ china that does not have a metal trim ✓ round utensils instead of square ✓ covers - plastic film - paper towels - paper plates - waxed paper ✓ porous materials, such as paper, should be used with dry-surfaced foods	✗ metal ✗ aluminum foil ✗ paper goods made from recycled paper (some paper towels are made from recycled paper)

Table 11.1

popular trademark for a durable plastic used as a nonstick coating.

Plastic or rubber utensils should be used with the nonstick finishes because the finish can be damaged by metal utensils or steel wool. If scratches occur, the utensil is still safe to use. However, there has been some controversy as to the safety of using utensils with scratched finishes. Some people have been concerned with the possibility of food being contaminated with flakes of the fluorocarbon resin.

◆ Essential Questions: ◆
Materials Used for Cooking Equipment

1. How does the outside finish of a utensil affect the appearance of the final food product?
2. Which metal can be adversely affected by acidic solutions?

BASIC UTENSILS

Figure 11.2 represents basic meal preparation utensils needed for food preparation. Some people prefer to use electrical appliances that can perform tasks, such as toasters, electric skillets, blenders, food processors, mixers, electric knives, and waffle irons, rather than using basic utensils.

Quality in food preparation cannot be achieved unless ingredients are carefully measured. Measuring cups and spoons are used for measuring both liquid and dry ingredients. A typical set of U.S. Standard graduated dry measuring cups include 1/4 cup, 1/3 cup, 1/2 cup, and 1 cup. Liquid measuring cups have a pouring spout and are used to measure liquid cups and ounces. Horizontal lines on the outside of the measuring cups indicate the increments of measurements. Liquid cups are made of glass or clear plastic. Measuring spoons are used to measure small amounts of both liquid and dry ingredients. A standard

Basic Utensils

- graduated measuring cups for dry ingredients
- measuring cups for liquid ingredients
- graduated measuring spoon set
- two to three sizes of mixing bowls
- skillets or frying pans, at least one with a lid
- set of saucepans
- shallow roasting pan
- two layer cake pans
- loaf pan
- twelve section muffin pan or two six section muffin pans
- cookie sheet/baking sheet
- one or two pie plates
- casserole dishes preferably with lids
- vegetable peeler
- grater/shredder
- kitchen shears
- tongs
- long handled fork, solid spoon, and slotted spoon
- set of sharp knives
- knife sharpener
- cutting board
- rolling pin
- pancake/hamburger turner
- metal spatula
- rubber spatula
- colander
- graduated sizes of refrigerator/freezer storage containers with lids

white mixtures. Stainless steel bowls are used by food service operations because of their durability.



Skillets or frying pans are used for cooking food in a small amount of fat. They can be used for pan-frying or sautéing (cooking in a small amount of fat), browning, or making sauces and liquids that require volume reduction (removal of air from a liquid). They have sloped sides to make access to the food easier when a spatula is used. They are available in many sizes and from a variety of metals, including stainless steel, cast iron, and copper-clad stainless steel.



Figure 11.2

set of measuring spoons includes 1/4 teaspoon, 1/2 teaspoon, 1 teaspoon, and 1 tablespoon. Measuring spoons are usually made of metal or plastic.

Mixing bowls can be made of glass, aluminum, stainless steel, or plastic. Glass bowls can break easily and should be handled carefully. Aluminum bowls tend to darken egg

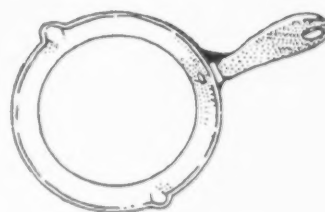
Saucepans are deeper than skillets and have straight or slanted sides, lids, and long handles. They are available in many sizes and made from a variety of metals, including cast iron, stainless steel, and copper-clad stainless steel. Standard sizes for home use are one, two, and three quart capacities.

Shallow roasting pans are large rectangular pans used for roasting meat, poultry, and fish. Cake pans may be round or square with two-inch sides. They are used for making layer cakes and coffee cakes. Loaf pans are used for baking bread or meatloaf. Muffin pans are used for baking muffins and rolls. They are available with six or twelve sections in standard or small sizes. Baking sheets are flat metal utensils that have at least one raised edge. Some may have four raised edges. They are used for baking cookies, biscuits, and various sweet rolls. Pie pans are used not only for pies but for other dishes as well. Materials used include glass, aluminum, aluminum foil, and opaque ceramic. Standard sizes include the eight-inch and the nine-inch wide pans.

Casserole dishes are available in a variety of sizes, shapes, colors, designs, and materials. Some are available with lids while others are not. Opaque, ceramic, glass, earthenware, and baked-on enamel materials are used most often to make casserole dishes.

A vegetable peeler is used for peeling and for slicing thin strips of fruits and vegetables. It also may be used for removing the cores from fruits and vegetables. A grater is used to grate, shred, slice, and serrate foods such as carrots, cabbage, and cheese. Vegetable peelers and graters have blades made from stainless steel. They may be either square or flat with different shapes and sizes of slots or grids. Kitchen shears are used for snipping fresh herbs, cutting garnishes, and trimming pastries. They may be used for many other kitchen tasks. Tongs are used to grasp a food item to lift and turn during the cooking process. Tongs are made of metal, and the

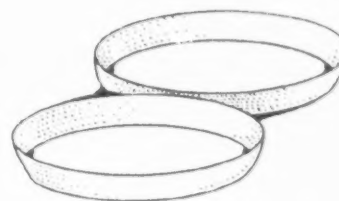
skillet



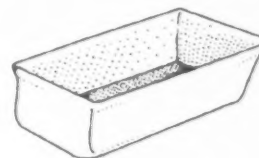
saucepan



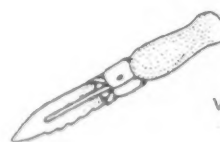
cake pan



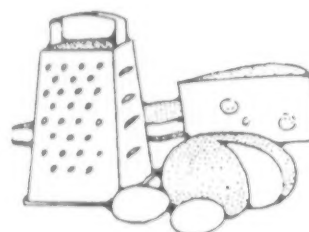
loaf pan



vegetable peeler



grater



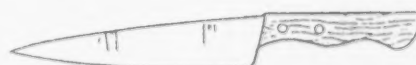
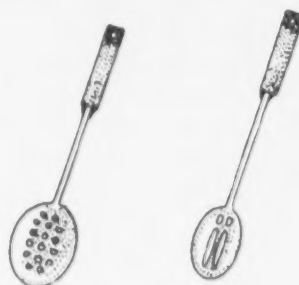
handles are often covered with plastic or rubber.

Long-handled forks, solid spoons, and slotted spoons have extra long, heat-resistant handles. The long handles enable hands to stay away from hot foods, spattering fat, and steam.

Knives are very important tools in the kitchen. A good set of sharp knives is necessary for cutting, slicing, and dicing foods safely and effectively. Most knives are made of stainless steel. Stainless steel is very durable and does not rust, and the blade stays sharp. Some blades are made of high carbon steel, which is very hard and durable. One disadvantage of high carbon steel is that it stains easily and must be scoured after each use.

The two major parts of a knife include the blade (the sharp portion) and the haft or handle. The tang, or the metal extension of the blade, is the portion that extends into the handle or haft. The tang should run the entire length of the knife and be attached with at least two rivets. Rivets are metal bolts or pins used to hold the handle and the blade portions together. Handles of knives are made of wood or plastic. Knives should be washed by hand, rinsed, and dried as soon as possible. Knives should not be washed in a dishwasher. Knives do not keep a sharp edge if washed in the dishwasher.

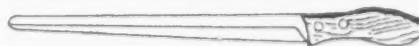
A French knife has a wide, curved blade approximately ten to twelve inches long that tapers into a point at the end and is used for chopping, mincing, dicing, and slicing foods. A paring knife has a blade that is two to three inches long. It is used for trimming or cutting away skins from fruits and vegetables. A slicer knife has a long, narrow blade that is ten to sixteen inches in length. It is used to slice vegetables and meats or to cut cakes and sandwiches. The blades of bread knives have serrated (saw-like) edges that allow them to cut easily through bread crusts.



French knife



paring knife



slicer knife



bread knife

Knives are easier and safer to use when they are kept sharp. A knife sharpener or sharpening steel is used to file the edges of knives to make them sharp. These are made of steel that is harder than the steel used to make knife blades. The steel of the knife sharpener may be flat, cylindrical, or oval, and it may have a steel shaft.

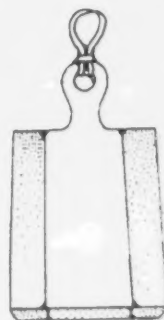
Cutting boards are surfaces on which foods can be cut. Hard rubber and plastic are recommended. They are easier to clean and are more sanitary than wood.

Rolling pins are made of smooth hardwoods and are used to roll out dough or crush bread crumbs.

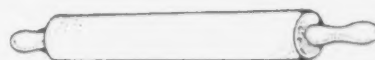
Spatulas have flat, thin, flexible blades with dull, rounded edges. They are used to turn meat, pancakes, potatoes, and other foods while browning. An offset or bent handle keeps the hand away from the hot cooking surface. The blade may be solid or perforated. The blades are made of plastic, rubber, or stainless steel.

Colanders are perforated metal or plastic bowls with a pedestal base and may or may not have handles for lifting. They are used to drain cooked foods such as pasta and to rinse salad greens and berries.

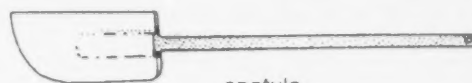
Storage containers are used for foods both before and after they are cooked. Containers used should have tight-fitting lids or be covered tightly with an appropriate wrap.



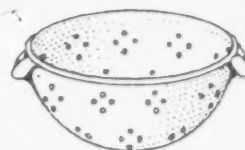
cutting board



rolling pin



spatula



colander

◆ **Essential Questions:** ◆
Basic Utensils

1. What is included in a typical set of U.S. Standard measuring cups?
2. What are the two parts of a knife?
3. What types of utensils should not be used in the microwave and why?



Chapter Highlights

- ☆ The quality of bakeware and cookware is measured by their ability to conduct heat evenly, clean easily, and remain durable.
- ☆ Cast iron is the traditional material used for cookware and bakeware.
- ☆ Aluminium is a good conductor of heat, but it should not be used for storing food or for cooking foods for a long time.
- ☆ Pure copper cannot be used alone for cooking because it reacts with certain foods, causing poisonous compounds.
- ☆ Enamelware is made by a process that fuses or melts several layers of a glass-like material on an iron base.
- ☆ A good set of sharp knives is necessary for cutting, slicing, and dicing foods safely and effectively.

Chapter 12

Principles of Food Preparation



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

SE Apply the principles of food preparation to preserve quality and nutritive value of foods.



Chapter Vocabulary

albumen

butterfly

candling

chalaza

connective tissue

emulsifiers

fillets

gelatinization

legumes

marbling

modified starches

papain

poaching

trichinosis

yolk

Protein, vitamins, and carbohydrates react to heat differently, and various cooking methods affect them differently. Each has characteristics that make its preparation requirements unique. It is important to know proper procedures and principles of cooking to adequately prepare foods for maximum flavor, appeal, and nutrient retention.

FACTORS AFFECTING PROTEIN COOKERY

Protein is sensitive to heat. High cooking temperatures make protein foods tough and dry. Low temperatures allow the protein to coagulate or thicken and hold in its natural juices. Protein foods include eggs, meat, fish, poultry, legumes, cheese, and milk.

Eggs

Protein is the most prevalent nutrient found in eggs. The protein is concentrated in the yolk of the egg. An egg consists of a white and a yellow portion contained in a shell. The white portion is called the **albumen**. The yellow portion is called the **yolk**.

The yolk is held in place by the **chalaza**, which is twisted, cord-like strands of heavy egg white. In the large end of the egg is an air cell. A freshly laid egg has no air cell. As moisture evaporates from an egg, the air cell is formed. The older the egg, the larger the air cell.

The shell of an egg is porous. It permits moisture and gases to pass through. On the outside of the shell, a thin film called the bloom helps to seal the pores and protect the egg from contamination. The color of the shell may be white to brown depending on the breed of chicken that laid the egg. The color of the shell does not affect the egg's nutritive quality.

The freshness or quality of an egg is judged by a process called **candling**. The candling process involves placing an egg on rollers over high intensity lights that make the interior of the egg visible to the grader (inspector). The eggs are rotated on the rollers so that the entire contents can be viewed. The outline of the egg yolk and the size of the air cell are examined. The freshest egg, Grade AA, has a thick egg white which supports a rounded, firm egg yolk. The air space at the wide end of the egg is small. Anyone can check the quality of an egg by holding it up to a bright light to determine the size of the air space. The smaller the air space, the fresher the egg.

Forms of Eggs Available. Eggs may be purchased fresh, frozen, and dried. Whole eggs, whites, and yolks may be processed in liquid, frozen, and dried forms.

Fresh eggs may be purchased in the shell. Fresh, whole eggs are washed before being packaged. After they are washed, the eggs are sprayed with a fine mist of oil to reseal the pores and prevent loss of moisture through the shell. Liquid eggs may be purchased in cans whole, yolks only, or whites only. Fortified eggs are a mixture including more egg yolks than egg whites.

Frozen eggs are often less expensive than liquid whole eggs. Frozen eggs also may be purchased whole, yolks only, or whites only. Frozen eggs must be kept frozen until ready to be thawed and used. Thawed frozen eggs and reconstituted dried eggs are highly perishable. Careful handling is essential to prevent contamination. Frozen eggs should be stored in the freezer at 0°F or below and thawed in the refrigerator. Thawed eggs should be used immediately, or they should be stored in the refrigerator in a tightly sealed container and used within twenty-four hours.

Dried eggs are available whole, yolks only, or whites only. Dried eggs are vacuum packed or packed without air. Unopened packages of dried eggs should be stored in a cool, dry place or in the refrigerator. The storage temperature should be no higher than 50°F. After opening, any unused portion should be refrigerated in an airtight container. Only the amount needed should be reconstituted (mixed with the right amount of water to return it to its original form) at any one time. Reconstituted eggs should be used immediately, or they should be refrigerated in an airtight container and used within one hour.

Food technologists have developed egg substitutes primarily for individuals who must control their intake of cholesterol and fat. Egg substitutes are lower in fat, cholesterol, and calories. Egg substitutes are available in

two forms: complete egg substitutes and partial egg substitutes. The complete egg substitute contains no egg and is made from soy bean or milk proteins. The partial egg substitute includes egg whites, vegetable oil, and nonfat dry milk. It does not contain yolk due to the yolk's high concentration of cholesterol. Many of these substitutes can be purchased in liquid, frozen, and dried forms.

The flavor of egg substitutes is different from that of real eggs. However, egg substitutes do blend well with other ingredients. They can be substituted for whole eggs in recipes and can be used alone for scrambled eggs or omelets. Milk protein egg substitutes are not suitable in some recipes because they do not provide the thickening power of real eggs. Cakes made with egg substitutes do not rise as well as cakes made with real eggs.

Egg Cookery. Eggs coagulate or thicken when they are cooked. The degree of coagulation depends on the product, the cooking temperature, and the length of cooking time. This makes them good products to use as thickeners for foods, such as puddings, custards, and sauces. Low temperatures must be used or the product may curdle or develop a tough texture. Overcooking also causes the product to curdle. When eggs are heated, the protein coagulates and makes the structure of the egg become tender yet firm. If the heating process continues for too long or if the temperature is too hot, overcoagulation occurs making the protein become tough and rubbery. This is true not only of eggs, but of all protein foods whether meat, milk, or cheese.

Eggs can be used as main dishes or as ingredients in a variety of recipes. When eggs are used alone, they should be of high quality. Eggs may be used as ingredients to bind, emulsify, thicken, coat, or leaven. When used as an ingredient in a recipe, eggs contribute the following:

- nutritive value
- color, flavor, and texture

- leavening capabilities
- emulsifying capabilities
- binding of ingredients
- a coating for foods that are fried



Eggs contain complete protein, which includes all amino acids needed by the body. They can be substituted for meat. Two eggs equal one 2 to 3-ounce meat serving. Figure 12.1 identifies the nutrients in the yolk and white of an egg in order of predominance.

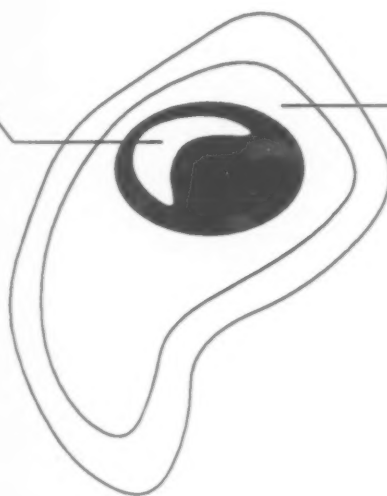
When air is beaten into eggs, they act as a leavening agent. Egg white foams are used to leaven puffy omelets, soufflés, meringues, angel food cakes, and other foods. Beaten egg yolks or whole eggs also help to leaven baked products that contain other leavening agents besides air. They also add moisture to form steam, adding to the leavening action.

Eggs are also emulsifiers. *Emulsifiers* hold oil and another liquid together so that the oil is distributed evenly throughout the mixture. Without the emulsifier, the oil and liquid would separate and the oil would rise to the top. When eggs are used as emulsifiers, the egg yolk forms a film around the particles of oil keeping it suspended in the liquid. Mayonnaise is an example of a permanent emulsion in which eggs serve as the emulsifier. The eggs hold the oil and vinegar or lemon juice together.

As a binding agent, eggs are used to hold other ingredients together. Eggs hold the ingredients in foods like meat loaf and salmon croquettes together. Since only a small portion of the ingredients in the product is egg, higher temperatures may be used.

Yolk Contents

Fat
Protein
Cholesterol
Phosphorus
Carbohydrates
Calcium
Potassium
Sodium
Magnesium
Iron
Riboflavin
Zinc
Vitamin B₆
Thiamin
Folate
Niacin
Vitamin A



White Contents

Protein
Sodium
Potassium
Calcium
Phosphorus
Magnesium
Riboflavin
Niacin
Iron
Zinc
Thiamin
Vitamin B₆
Vitamin B₁₂

Figure 12.1

Foods to be fried may be dipped in a beaten egg mixture then coated with bread crumbs, flour, or cornmeal. The eggs cause the crumbs to stick to the food. Cutlets, fish fillets, and other foods are coated in this manner fried.

The high protein content of eggs dictates the principles of egg cookery. High temperatures and overcooking cause the protein to toughen, curdle, and discolor.

Overcooked eggs develop a dark green ring around the yolk. This discoloration is due to the interaction of the iron and the sulfur in the egg. High temperatures and overcooking also make the egg whites rubbery. To prevent this discoloration, the following should be observed when hard-cooking eggs:

- Simmer eggs for fifteen minutes
- Avoid overcooking eggs.
- Cool eggs immediately after cooking by placing them under cool, running water.

Cooking eggs in the microwave oven requires special precautions. Eggs should never be cooked in the shell in the microwave oven. Because the fat content in the egg yolk causes it to cook faster than the egg white, the pressure builds from the yolk and causes the egg to explode. Eggs should be broken and placed in a small microwavable dish. The yolk should be pierced and the bowl covered tightly. Eggs cooked alone should be cooked on a low setting. Higher temperatures can be used when eggs are used as ingredients in such products as casseroles.

Storage of Eggs. The quality of eggs begins to decline as soon as they are laid. As eggs deteriorate in quality, the white becomes thinner, the yolk flattens, and the air space increases. Proper storage can slow this process. Fresh eggs should be kept refrigerated until they are used. Eggs should be stored in the refrigerator with the pointed end down, away from heat and light. Eggs retain their high quality for weeks at temperatures of 55°F to 45°F. Their quality declines rapidly at room temperature.

Most egg dishes should be served immediately. Hard-cooked eggs in the shell may be kept safely for several weeks in the refrigerator. Cream, custard, or meringue pies or goods with custard fillings should be refrigerated immediately after preparation.

Refrigeration helps prevent the growth of salmonella (bacteria that causes a type of food poisoning).

Meat

Meat is an excellent source of complete protein, B vitamins, and iron. It is difficult to obtain sufficient amounts of iron if meat is not included in the diet. However, fat and cholesterol are also present in meat. Many people have reduced their consumption of high fat meat products because of a desire to lower fat and cholesterol intake. Trimming off the excess fat on meat reduces the fat content as well as the cholesterol content.

In general, the term meat refers to beef, veal, pork, lamb, or mutton. Beef is flesh from fully grown steers, cows, or bulls. Beef used for slaughter is typically from steers. Steers are castrated or neutered bulls (male cattle). The meat from steers is more tender than that from a bull or cow. Occasionally, female cows are used for slaughter if they have been injured or are no longer able to produce offspring. Veal is the flesh from baby calves and pork is the flesh of pigs or hogs. Pigs are young swine that have not matured and weigh less than 120 pounds. Hogs refer to swine that weigh more than 120 pounds. Lamb is the flesh of young sheep that are less than one year old, and mutton is the flesh of a grown sheep. Meat from these sources is often called red meat to distinguish it from poultry and fish.

Meat is made of muscle, connective tissues, fat, and bone. Muscle is composed of fibers which are held together by **connective tissue**. The amount of connective tissue affects the tenderness of the meat. The more connective tissue, the less tender the meat.

Fat is found in layers on the surface of the meat and in small flecks or streaks throughout the muscle. The small flecks of fat are called **marbling**. Bone is part of the skeleton of the animal. The amount of bone in meat depends on the cut of meat.

Cuts of Meat. Cuts of meat can be classified into three groups: tender cuts, less tender cuts, and variety meats. The tenderness of each cut is related to its location on the animal. Tender cuts include the loin and ribs of beef, veal, lamb, and pork. They also include the leg of veal, lamb, and pork. Less tender cuts include the round, rump, flank, and chuck of beef. The shoulder and breast of veal and lamb are less tender cuts. The shoulder of pork is also a less tender cut of meat. Variety meats (organ meats) include the liver, kidney, heart, tongue, and brains of beef, veal, lamb, and pork. The sweetbreads (the thymus or pancreas) of beef, veal, and lamb are other variety meats. Liver is the most popular variety meat.

The less tender parts of the animal may be cubed or ground. Ground meat is often made from trimmings and cuts of meat that cannot be sold, and ground beef is purchased by the percent of lean meat to fat. The maximum fat content is limited by law to 30 percent. Hamburger meat is usually, but not always, ground beef. Unless it is labeled "pure ground beef" it may contain some pork. Ground pork is often made into sausage.



Meat Cookery. Meat requires little preparation before cooking. Different methods of cooking are used for tender and less tender cuts of meat. Less tender cuts of meat may be tenderized by chemical or physical means or by cooking. A commercial powder or liquid tenderizer containing the enzyme

papain may be used to chemically break down the connective tissue in the meat. Another chemical means for tenderizing meat is by marinating. To marinate, the meat is soaked for several hours in an acid food like tomato juice, vinegar, or lemon juice to break down the connective tissues. Some meats are tenderized by a chemical that is injected into the bloodstream of the animal and breaks down the connective tissue. These meats are more tender than other meats. The tenderizing chemical is injected into the animal's body shortly before it is slaughtered and is carried throughout the animal's body in the bloodstream.

Connective tissue can be broken down physically by cutting, grinding, scoring, or pounding the meat. Grinding is crushing meat into bits as with a meat grinder. Scoring is done by making shallow cuts across connective tissues. Pounding is done with a mallet that has sharp points to break down the connective tissue.

Cooking meats improves the flavor, appearance, and tenderness. It also destroys harmful microorganisms. Cooking coagulates or hardens the protein in the lean part of the meat while it softens the protein of the connective tissues.

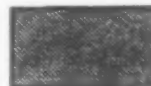
Meats are cooked to different stages depending on the type of meat, the person cooking the meat, and the preference of the individual who will eat the meat. The four basic cooking stages are rare, medium-rare, medium, and well-done. Figure 12.2 identifies the characteristics of each stage.

Pork and veal always should be cooked to the well-done stage. Pork always should be cooked well because of possible trichina parasites that might be present. Trichina are small wormlike parasites that are in the larval state. They are occasionally found in the flesh of pork. **Trichinosis** is a disease that can result if these parasites are not destroyed through the heat of the cooking process and are ingested.

Cooking Stages of Meat

Rare

The meat is somewhat crisp and dark on the outside and red and juicy on the inside.



Medium-rare

The outside of the meat is darker than rare with only a strip of red on the inside.



Medium

The inside is primarily gray with only a hint of pink.



Well-done

The meat is cooked evenly throughout with no pink color visible.

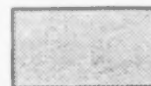


Figure 12.2

Veal must be cooked to the well-done stage to develop flavor.

Meat may be cooked with one of three types of heat: dry, moist, or in fat. Dry heat is used for cooking tender cuts of meat. Dry heat cooking methods do not require the use of additional fats or liquids. Examples of dry heat methods of cooking include the following:

- **Roasting** is baking large cuts of meat in the oven at 300°F to 350°F without the addition of moisture. The meat is placed fat side up on a rack in a shallow, open pan. The rack

allows the heat to circulate around the meat for even heating.

- **Salt** can be added to the meat before it is cooked. The salt only penetrates into the meat about one-half inch giving the roast a pleasant crust.
- **Broiling** is cooking by direct heat from hot coals, a gas flame, or a glowing electric element. The cooking temperature is controlled by the distance the meat is placed from the heat source. Meat selected for broiling should be three-fourths to one inch in thickness and placed three to five inches away from the heat source. When the meat is cooked on one side, it should be turned over to allow the other side to brown. If the meat is to be salted, the salt should be added after the meat has cooked because the salt will interfere with the browning of the meat. The salt also draws the natural juices out of the meat where they will evaporate, resulting in a dry piece of meat.
- **Grilling or panbroiling** is used for small, tender cuts of meat. The meat is placed on the solid surface of a grill or hot plate and cooked on one side. Then the meat is turned over and cooked on the other side. Usually no additional fat is needed.

Moist heat is used for cooking less tender cuts of meat. Moist heat methods tenderize the meat by cooking it slowly in moisture at low temperatures. Beef short ribs, Swiss steak, pepper steak, and beef pot pie are examples of less tender cuts of meat that are cooked in one of the moist heat methods. Examples of moist heat cooking methods include the following:

- **Braising** is cooking meat in a covered pan in its own juice or with a small amount of added liquid. The meat can be browned slightly before the liquid is added. This method can be used for all less tender cuts of meat as well as for tender cuts of pork and veal.
- **Stewing** is cooking meat covered with water or other liquid and simmering or stewing until tender. Less tender cuts of

meat and variety meats are cooked by this method.

Foods cooked in fat cook at a higher temperature than other cooking methods. The amount of fat varies depending on the cooking method. Methods of cooking in fat include stir-frying, pan-frying, and deep-fat frying. Very little fat or oil is used in stir-frying. The food cooks quickly, allowing its natural flavor to emerge. Pan-frying is also known as sautéing. The meat can be coated with a batter and crumbs to create a crust or it can be pan-fried without a coating. A small amount of fat is melted in the bottom of a frying pan, and the meat is placed in the melted fat. One side is cooked, then the meat is turned over and the other side is cooked. Deep-fat frying is achieved by totally immersing a coated piece of food into hot fat. Variety meats, also called organ meats, are more perishable than other meats and should be cooked soon after purchase. Table 12.1 identifies ways various variety meats should be cooked.

Ways to Cook Variety Meats

Variety Meat	Cooking Method
Brains	Braise, broil, cook in water, or fry
Heart	Braise, cook in liquid
Kidney (lamb and veal)	Broil
Kidney (beef)	Braise or cook in liquid
Liver	Fry, braise, broil, pan-broil or pan-fry
Tongue	Moist heat

Table 12.1

Microwave Cooking of Meats

Cooking meats in the microwave oven results in less shrinkage than cooking in a conven-

tional oven. Containers used for cooking meat in the microwave oven should be just large enough to hold the cut of meat and the liquid or juices. The meat should be cooked on a higher power setting first for browning purposes, then the power should be reduced to allow for adequate cooking of the inside of the meat. The meat should have an even shape or be cut into similar sized pieces. As with conventional cooking, the meat should be allowed to stand after the power has been turned off to allow it to absorb the natural juices and complete the cooking process. The following are other procedures for cooking meat in the microwave oven:

- Meat should be completely defrosted before cooking begins in order to ensure even cooking.
- Chops and steaks can be scored (cut diagonally) to prevent the edges of the meat from curling.
- Bacon should be covered with a paper towel to avoid splattering.
- Meat for stews should be completely immersed in the cooking liquid.
- Meat should be rotated during both the defrosting and cooking stages at least once halfway through the cooking process.
- Fat that drips from the meat during the cooking process should be removed often. If not, the microwave will direct its power to the fat instead of the meat.

Fish

Fish, like meat, poultry, milk, and cheese, is rich in protein. Fish contains little connective tissue and cooks quickly. Sufficiently cooked fish is easily flaked with a fork.

The method for cooking fish depends on the type of fish being cooked (finfish or shellfish), whether the fish is frozen or fresh, the amount of fat in the fish, and the preparation needed before cooking. Finfish are fish with scales and fins, such as halibut and catfish. Shellfish are fish with hard shells, such as shrimp and lobster.

Fish cooks quickly because it is naturally tender. Cooking improves the appearance of fish and brings out its flavor. Moderate cooking temperatures should be used to prevent overcoagulation of the protein. Overcoagulation makes the fish tough. The fish is cooked when the flesh looks milky white and separates easily with a fork.

Finfish Cookery . Fresh finfish may be purchased in several forms. They may be purchased whole, dressed, as steaks, and as fillets. Whole fish is sold just as it is taken from the water with the entrails (inner parts) intact. Dressed fish is a whole fish with the internal organs, scales, head, tail, and fins removed. Fish steaks are cross-section slices from a large dressed fish. **Fillets** are boneless lengthwise cuts from the sides of the fish along each side of the backbone. If a piece of skin is left to hold the two sides together, the cut is called a **butterfly**. The shape of the piece resembles a butterfly. Only small, thin fish can be cut in a butterfly. Figure 12.3 displays forms of fish.

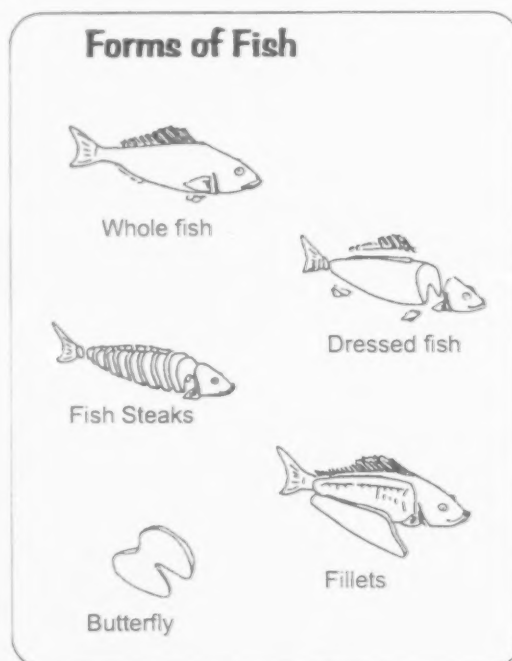


Figure 12.3

Finfish are cooked by baking, poaching, steaming, broiling, sautéing, and deep-fat frying. The method of cooking is most influenced by the amount of fat in the fish. Fat fish are those containing up to 20 percent fat. Fat fish are usually cooked by broiling, barbecuing, or baking. Examples of fat fish include the following:

- catfish
- eel
- herring
- mackerel
- mullet
- salmon
- sardines
- tuna
- trout
- other colored fish (fish with pink flesh, not gray or white)

Lean fish are better for steaming, sautéing, and deep-frying. Lean fish contain between 2 and 6 percent fat. Examples of lean fish include the following:

- cod
- flounder
- haddock
- halibut
- red snapper
- swordfish

The cooking method for finfish also is influenced by the size and thickness of the piece. Large, whole fish may be baked or stuffed. They also may be steamed or poached. **Poaching** refers to strapping the fish in cheesecloth to keep it from breaking apart and simmering it in seasoned water in a covered pan. Small, whole fish may be sautéed or pan-fried. Fish steaks and fillets may be broiled, sautéed, baked, or fried.

It is often a good idea to make several diagonal cuts or slits on both sides of a whole fish prior to cooking. These cuts or slits will help prevent the side closest to the heat source from curling up. For even cooking, fish should lie flat during the cooking process.

When broiling fish, it is beneficial to brush the fish with oil or butter before cooking. The oil or butter helps hold in the moisture of the fish and helps create a crisp skin. The coating of oven-fried fish also helps hold in the moisture and absorbs the heat needed to cook the meat.

Shellfish Cookery. Examples of shellfish include the following:

- clams
- crab
- lobster
- oysters
- scallops
- shrimp



Appropriate cooking methods for shellfish vary. Medium-sized shrimp are usually boiled or steamed and served whole and cold as shrimp cocktail or on a salad. Small shrimp are used in casseroles or salads. Regardless of the cooking method used, care should be taken not to overcook shrimp. They should be cooked until they turn pink. Overcooking makes shrimp tough, tasteless, and dry.

Lobsters may be boiled, broiled, baked, sautéed, or deep-fried. Lobsters can be stuffed before being baked. Crab should be boiled or deep-fried.

Scallops may be sautéed or deep-fried. Clams may be breaded and fried whole or in strips or diced and formed into shapes or patties. Oysters can be baked, stewed, or fried.

Convenience Fish Products. A variety of convenience fish products are available. The convenience forms of frozen fish include the following:

- frozen fillets
- steaks
- fish sticks
- fish pies
- chowders (soup or stew made with seafood)

Frozen processed fish products may be breaded and ready-to-cook, or they may be precooked and require only heating before being served. Canned fish may be used in salads and in sandwiches. It also may be used as an ingredient in any recipe that calls for cooked fish, such as salmon croquettes. Smoked fish are ready-to-eat.

Microwave Cooking of Fish. Both finfish and shellfish have a high moisture content. This makes them good candidates for microwave cooking. Fish cooks quickly in the microwave oven and should be cooked only until the meat loses its translucent or shiny appearance and becomes white or dull in color. Fish, like meat, will continue to cook even after the power has been turned off, making timing a critical factor. Fish should be rotated or turned at least twice during cooking because of their uneven shape.

Many convenience fish foods also can be cooked in the microwave. Most product packages available today give directions for microwave cooking. If not, breaded fish should be cooked uncovered. All other fish dishes should be covered during the cooking process to help retain moisture.

Poultry

Poultry is the term used to describe domestic birds raised for food. Common types of poultry include chickens, turkeys, ducks, and geese. The most common types of poultry are chicken and turkey.



The following are the classifications of chickens:

- A *broiler* is a young bird of either sex weighing one to two and one-half pounds. It is small and has little meat in proportion to bone.
- A *fryer* is a young bird of either sex weighing two and one half to three and one half pounds. It is meaty and has some fat under the skin.
- A *hen* is an older female (less tender).
- A *roaster* is a male bird that weighs more than three and one-half pounds. It is very meaty and has a layer of fat beneath the skin. Roasters are usually cooked whole.
- *Capon* are young castrated or neutered males that weigh four to seven pounds. They have a high proportion of white meat and usually are roasted.
- *Stewing hens* are heavy, mature birds that weigh four to six pounds. The meat is flavorful but less tender than that of younger birds. Stewing hens are usually braised or stewed.

Turkeys are classified as broilers or roasters. The following are turkey classifications:

- *Broilers* are young turkeys of either sex weighing three to seven pounds and having little fat.
- *Roaster toms* are male turkeys weighing eight to twenty-five pounds.
- *Roaster hens* are female turkeys weighing three to fifteen pounds. Roaster hens have more fat than roaster toms.

The older the bird, the more developed the flavor of poultry. With age, the bird also develops tougher muscles. Age results in a more flavorful yet tougher meat. The age and sex of the bird are the primary factors affecting flavor and tenderness. The young tender birds can be cooked with dry heat while the older, less tender birds need moist heat. Female birds tend to be smaller and more tender than male birds, which are generally larger.

Poultry Cookery. The classification of poultry gives a good indication of the appropriate methods of cooking. Very young chickens and turkeys may be broiled. Very young chickens also can be fried. Fully mature chickens and turkeys can be roasted. Older mature chickens should be braised, fricasseed, or stewed. Fricasseed refers to the process of stewing cut up pieces of meat in a stock and serving it in a white sauce.

Poultry may be purchased whole or in parts. It is available fresh, frozen, or canned. Fresh poultry is sold dressed and ready to cook. Dressed poultry refers to poultry from which the feathers, head, feet, internal organs, and blood has been removed. The liver, heart, and gizzards (known as giblets) are washed and placed in a bag then placed inside the body cavity of the bird. It may be sold whole, in half, or in pieces, such as breasts, thighs, and legs. Whole birds, such as turkeys and Cornish hens, are often sold frozen. Pieces and cooked poultry pieces also are sold frozen.

Poultry can be marinated (soaked in a flavorful, acidic sauce) to add flavor and to tenderize. Marinating poultry at room temperature for a short time is not recommended because it promotes spoilage. Poultry can be marinated in the refrigerator safely, but it should not be marinated for more than two hours. Marinating for more than two hours can overtenderize the meat as well as change the texture of the meat to a mushy consistency.

Poultry can be prepared in a variety of ways. Chicken is popular as a convenience food item in the form of chicken bits or nuggets. Sliced chicken and turkey are common sandwich ingredients. Roasted turkey is the traditional entrée for Thanksgiving dinner. Fried chicken is a popular convenience food, and baked chicken is a favorite main dish. Specialty poultry entrées include Cornish hen, pheasant, and duck. Stewed chicken is an ingredient in many casseroles. The white

meat of chicken and turkey is popular as a main dish salad ingredient.

Rare or raw poultry should not be eaten due to the risk of foodborne illness. Raw or rare poultry provides a favorable climate for bacteria to grow. Poultry should be cooked to a high enough temperature for a sufficient amount of time to kill potentially harmful bacteria. Chapter 9 gives detailed information on food safety and prevention of foodborne illness.

Legumes

Legumes are the seeds and pods of leguminous vegetables. The term legume includes dried legumes, lima beans, peas, and string beans. Legumes can be purchased dried, canned, and frozen.

Dried legumes are dried seeds and pods of leguminous vegetables including black beans, black-eyed peas, garbanzo beans, kidney beans, lentils, lima beans, navy beans, peanuts, pinto beans, and soybeans. Dried beans and peas are graded U.S. #1, #2, and #3 with U.S. #1 being the best quality. Products graded U.S. #1 are free of foreign objects, such as sticks, stones, and dirt.

Dried legumes require soaking before cooking to rehydrate and soften the beans. Dried legumes may be soaked in cold water overnight or boiled for two minutes and allowed to soak for one hour. They may not soften as completely in hard water as they do in soft water. To improve the softening abilities of the legumes in hard water, one-fourth teaspoon of baking soda can be added to one quart of water at the beginning of the soaking period. The soda breaks down the structure of the legumes. Too much baking soda will result in soft, mushy beans and loss of thiamin and riboflavin. The beans will continue to soften during the cooking process.

Some legumes, called hard shell, will not soften regardless of the softness of the water.

Environmental factors and/or storage factors cause the cover of the seed to become less porous, thus limiting the amount of water that can be absorbed. The less water absorbed, the harder the legume.

Dried legumes should be placed in airtight containers and stored in a cool, dry place. These storage techniques help to prevent infestation by insects, fermentation, and growth of molds. If stored properly, dried legumes will keep their quality for several months.

The nutritive value of dried legumes is enhanced through the cooking process. The protein quality is improved while other potentially harmful substances are destroyed. To ensure the maximum nutrient retention, legumes should be cooked in the liquid in which they were soaked.

Lima beans are a common table vegetable. They also are used in casseroles and soups. The Fordhook and the dwarf lima bean are the two most common types.

Peas are round and grow in a shiny green pod. The field pea is round and smooth. The garden pea is round, wrinkled, and has a sweet flavor due to its high sucrose (sugar) content. Immediately after harvesting, the sucrose content begins to decrease while the starch content increases. Poor quality peas typically have a higher starch content than sucrose content. If peas are stored for long periods of time, the starch content will be high, negatively affecting the quality, flavor, and texture of the pea.

The sugar snap pea and the Chinese snow pea are both eaten with their pod. Either can be eaten raw or cooked. If cooked, they should be cooked quickly to retain crispness.

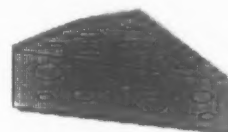
String beans are long and thin with small, immature beans within the pod. They can be purchased in broken pieces, cut pieces, whole, or French style. The cut has no impact on the

flavor or the nutritional value of the bean. It only affects how the bean looks.

Cheese

Cheeses must be selected for their intended use. Some cheeses are used mostly for appetizers, desserts, and salads. These cheeses include the following:

- brie
- Camembert
- Edam
- Gorgonzola
- Gouda
- Liederkrantz
- Limburger
- Roquefort
- Stilton

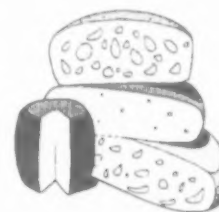


Some of these cheeses have very strong flavors that make them unsuitable for cooking. Others do not melt or blend well during cooking.

A good cheese for cooking should be meltable, blendable, and have a definite cheese flavor. When heated, the cheese should become soft and smooth; it should blend easily with other ingredients. The texture should be appropriate for the item being prepared. The flavor should be definite but not so strong that it overpowers the flavor of other ingredients.

Common cheeses used in cooking include the following:

- american
- cheddar
- colby
- cottage cheese
- cream cheese
- monterey jack
- mozzarella
- ricotta
- Swiss



American, cheddar, colby, mozzarella, and monterey jack cheeses may be purchased in blocks, bricks, loaves, moons, half-moons,

rolls, links, or they may be sliced, grated, shredded, or cubed. Other processed cheeses may be purchased in a variety of flavors in pressurized cans, such as spreads and dips, or as balls rolled in nuts. Cheese spreads are packed in jars. Convenience forms of cheese usually cost more than the same weight of cheese in a solid piece.

Soft cheeses, such as cottage cheese, ricotta, and cream cheese, are highly perishable. They must be used before the date marked on the package. Cottage cheese comes in several different varieties. It can be purchased as dry cottage cheese with no cream added or as creamed cottage cheese. It also may be purchased with added fruits, fresh garden vegetables, or chives.

Canned cheese soup or cheese sauces are also available. Canned cheese soup may be used as a sauce for au gratin vegetables, casseroles, meats, and pasta. In addition to products that are primarily cheese, a variety of convenience foods containing cheese are available. An example is macaroni and cheese mix.

Cheese Cookery. Cheese protein, like egg protein, coagulates when heated and becomes tough and rubbery when overcooked. Cheese should be cooked at a low temperature for a short time. When added to other ingredients, it should be cut into small pieces, shredded, grated, or sliced so that it will melt quickly and blend with other foods. High temperatures and overcooking cause cheese to become tough and stringy and may cause the fat to separate and drain from the cheese.

For best results, cheese should be cooked in a double boiler over simmering water or baked in an oven at a low temperature (325°F to 350°F). When cooking cheese over direct heat, use a low temperature and stir constantly to prevent scorching. When cooking cheese or cheese dishes, it is best to heat the mixture just long enough to melt the cheese.

This prevents the protein in the cheese from overcoagulating and becoming tough and stringy.

Cheese used as an ingredient in a recipe should be added to the dry ingredients first. When making cheese sauce, the cheese should be added after the white sauce is completely cooked and heated only long enough to melt the cheese. Some cheese dishes, like egg dishes, cannot be stored and reheated successfully. They should be served immediately.

Microwave Cooking of Cheese.

Cheese cooks quickly in the microwave oven due to its high fat content. It should receive special attention when cooked in this manner. It only takes a few seconds for the cheese to go from being properly melted to overcooked, tough, and rubbery. Low power and a short cooking time should be used when cooking cheese alone. Cheese used as an ingredient in other products can be cooked at higher temperatures and for longer periods of time.

Milk

Milk, like other animal protein, is sensitive to heat and should be cooked with as low a temperature as necessary for the shortest amount of time. When milk is overcooked, one or more of the following may occur:

- milk film
- boil over
- scorching
- curdling

Milk film forms on the bottom and sides of the pan. This film is caused by overheating of the milk proteins. The film can be prevented by using a double boiler, by using a covered container, by adding butter, and by stirring the milk constantly during the heating process.

When milk film forms on the top of the heated milk, it forms a tight, steamproof cover. The milk will foam and eventually boil

over unless precautions are taken. Scorching can occur if the milk is heated at too high a temperature for too long a period of time. Scorching can be prevented by cooking the milk at low temperatures and stirring during cooking.

Milk will curdle when heated if acid is added to it or when acid-producing bacteria attack the milk. The acid causes the milk proteins to separate and curdle. Vegetable acids in soups, such as tomato soup, may also cause the separation of milk proteins. Lemon juice in cream sauces for seafood may produce the same reaction. To reduce the possibility of curdling, acidic juices should be added after the milk has been cooked and prior to serving.

◆ **Essential Questions:** ◆
Factors Affecting Protein Cookery

1. What contributions do eggs make when used as ingredients in various recipes?
2. What can happen if cheese and milk are overcooked?
3. What are the four basic cooking stages of meat? Describe each stage.
4. What are some principles for cooking poultry? for cooking fish?

FACTORS AFFECTING FRUIT AND VEGETABLE COOKERY

Fruits and vegetables are excellent sources of vitamins. Vegetables are grouped according to the part of the plant from which they come, such as the roots, leaves, stems, flowers, fruits, seeds, and tubers. Fruits are seed-bearing plants used for food. Varieties are grouped as pomes (apples and pears), drupes (cherries), berries (grapes), citrus fruits, melons, and tropical fruits.



Vitamins help regulate body functions, growth, and development. Since fruits and vegetables provide many vitamins, their consumption by humans is important. Some vitamins are water-soluble and some are fat-soluble.

The goal when cooking fruits and vegetables is to retain the maximum amount of the original food value, color, flavor, and texture. This goal applies to all forms of vegetables and fruits—fresh, frozen, canned, and dehydrated.

Cooking Principles

Cooking softens the cellulose or structure of fruits and vegetables, making them less crisp. The starch in the fruit or vegetables absorbs water, swells, and becomes more soluble. Changes in color and flavor occur, and nutrients dissolve in the cooking liquid. To retain the best qualities, fresh vegetables and fruits should be cooked in as little liquid as possible for as short a time as possible.

The effects of moist heat on the cellulose of fruit is reduced by sugar. When fruits are cooked in moist heat, the fruit breaks apart. When fruit is cooked in sugar or sugar syrup, it retains its shape. The sugar strengthens the cellulose structure and keeps the fruit from falling apart. The decision to add sugar before or after cooking fruit should be based on the desired texture of the cooked fruit product.



Methods of Cooking Fruits and Vegetables

Fruits and vegetables may be boiled, steamed, baked, sautéed, fried, or broiled. They also may be cooked in a microwave oven. Canned vegetables and fruits are completely cooked in the canning process. They may be reheated in their own juices for maximum nutrient retention or used as ingredients.

Dried and dehydrated vegetables and fruits must be rehydrated or reconstituted with water. Dried vegetables may need to be soaked in water, then boiled. Dehydrated vegetables may be reconstituted with water before cooking, or they may be added to dishes high in liquid, such as soups. Dried and dehydrated vegetables can be boiled, simmered in water, or baked.

The following are recommended methods of cooking various fruits and vegetables:

- Boiling is the most popular method for cooking fresh vegetables. It can be used for fresh, frozen, canned, dried, or dehydrated vegetables and fruits.
- Steaming is fast, retains nutrients, and preserves the color of the vegetables.
- Vegetables and fruits may be baked whole or in pieces. Canned, dried, frozen, or fresh fruits can be combined with other ingredients to make a variety of dishes.
- Sautéing is cooking vegetables and fruits in a small amount of butter, margarine, or oil.
- Deep-fat frying is submerging food in hot fat. French fried or deep-fried potatoes are

popular. Other vegetables like onions, eggplant, cauliflower, broccoli, and squash may be dipped in batter and fried in deep fat. Batter mixed with pieces of vegetables or fruit and fried in deep fat is called a fritter. Corn fritters and apple fritters are best known in the United States.

- Broiling is cooking with direct heat under a flame or element. Tomatoes are the most popular broiled vegetable. Broiled grapefruit halves also are popular broiled fruits.

Other guidelines to follow when cooking vegetables include the following:

- Green vegetables should be removed from heat before they turn a brown-khaki color.
- White vegetables turn gray when they have been overcooked.
- Yellow vegetables should be removed from heat before the vegetables lose their yellow color.
- Add lemon juice or vinegar to the cooking liquid of red vegetables to help retain their color, especially in hard water areas.

Vegetables should be served immediately after they are cooked. Several vegetables can be combined to make a colorful dish. Some popular combinations include green beans and mushrooms, carrots and celery, cauliflower and peas, potatoes and green beans, and peas and pearl onions. Fruits may be garnished with whipped cream, ice cream, a dessert sauce, chopped nuts, or shaved chocolate.

Fruits cook very quickly in the microwave oven due to their high sugar and moisture content. Fresh fruit should be cooked in uniform sizes whether whole or cut. Fruit sauces should be covered to help retain moisture. Fruit dishes with crust should be left uncovered to prevent the crust from becoming soggy. Vegetables cooked in the microwave oven should be cooked with a smaller amount of water than that used with conventional cooking methods. Vegetables canned at home should not be cooked in the microwave oven because the temperatures and length of time

are not great enough to kill toxins that might be present.

◆ **Essential Questions:** ◆
**Factors Affecting Fruit and Vegetable
Cookery**

1. What principles should be observed when cooking fruits and vegetables?
2. What is the difference between fat-soluble and water-soluble vitamins? Why is this important to understand when preparing fruits and vegetables?

FACTORS AFFECTING CARBOHYDRATE COOKERY

Starch is a complex form of carbohydrate. Carbohydrates are stored in plants as starch. Starch is made up of a combination of many kinds of sugar. Starch is found in bread, cereal, potatoes, pasta, rice, and legumes. During cooking, starch absorbs water and thickens.

Grains and Pasta

Cereals and pasta are made from grains. Grains are the edible seeds produced by certain plants of the grass family. The principle grains are wheat, rice, oats, barley, rye, corn, and buckwheat. These grains also are referred to as cereal grains or cereals. Breakfast cereals, pasta (macaroni products), and flour are all made from cereal grains. Grains and grain products are inexpensive food sources that supply body energy. Grain products may be served at any meal. They make interesting and nutritious additions to any part of a meal and are easy to store and keep well.

With the exception of corn or maize, which is native to North and South America, all true cereal grains originated in Europe and Asia. Buckwheat is native to central Asia.

Pasta is ground grain food products including macaroni and noodle products. Macaroni products are made from a particular type of flour from durum wheat. The durum wheat has a very high proportion of gluten. When mixed with water, the gluten becomes very elastic, making it easy to stretch and cut into interesting shapes.

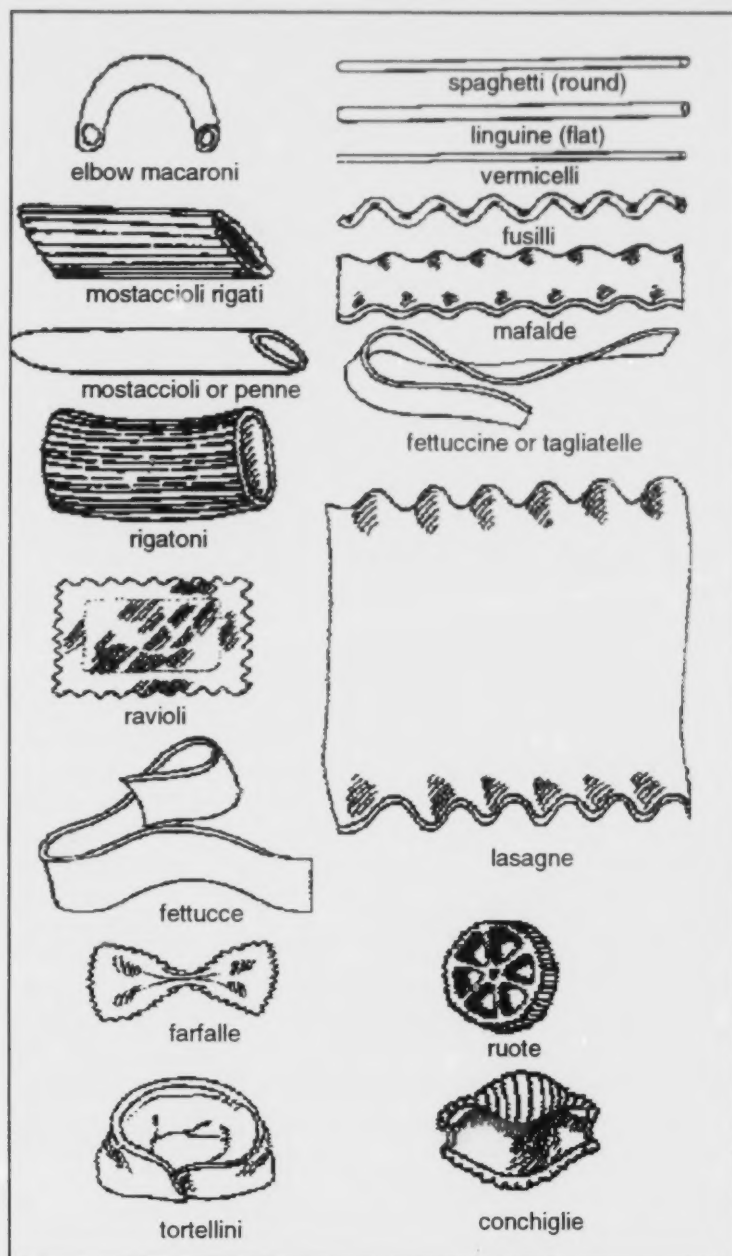
A variety of pasta products are available. Types of pasta include spaghetti, macaroni, lasagna, ravioli, and spirals. Pasta comes in four main shapes: tubes, rods, ribbon-like strips, and special shapes. Examples of the four main shapes are included in Figure 12.4.

Noodles differ from macaroni in that they are made from flour, water, and eggs. The eggs add flavor and tenderness to the pasta. The flour does not need to be a high protein durum flour because of the added egg.

Grain and Pasta Cookery. The cooking principles of starch apply to the preparation of both cereals and pasta. Starch is composed of microscopic granules that absorb liquid and swell when cooked. To prevent lumping of cereal granules, pasta and grain must be added slowly to rapidly boiling water while stirring or mixed with a small amount of cold water before they are stirred into boiling water. Whole cereal grains and pasta are larger pieces than cereal granules. They are added directly to boiling water and stirred briefly to separate.

As the product is heated, the following three things happen:

1. The starch absorbs water.
2. The heat of cooking causes the steam to form, which erupts the starch granules.
3. The released soluble starch causes the product to gelatinize.



Types of Pasta

- tubes include macaroni and rigatoni
- rods include spaghetti and vermicelli
- ribbonlike strips include lasagne and fettuccine
- special shapes include conchiglie, ruote, and farfalle

⇒ Figure 12.4

Gelatinization refers to the thickening or soft gel that forms when starches are cooked. This makes cooked cereals thicken. It makes rice or macaroni products become tender and easy to chew without breaking apart.

Breakfast cereals usually are served at the morning meal. Some are served hot while others are served cold. Cereals also may be used as toppings on casseroles or may be rolled into crumbs and used for breading meats, poultry, and fish. They also are used as ingredients in cookies, quick breads, and special desserts.

Rice is most often served as an accompaniment to meat, poultry, or fish and is occasionally served hot as a breakfast cereal. It may be one of the main ingredients in baked dishes and is frequently an ingredient in soups. Rice is also used in desserts.

Pasta can be used as a main dish like macaroni and cheese or chicken and noodles. Spaghetti or noodles can be used in addition to a main dish instead of a potato. Pasta also can be used as an ingredient in a main dish, soup, or salad.

Pasta and cereals may be boiled or steamed. The amount of water or liquid needed for cooking varies with different pasta and cereal products. The amount of water required is usually two to two and one-half times that of the cereal product. Precooked cereals, such as instant oatmeal, may take less water, so it is best to follow the directions on the package.

At least three times as much water as pasta is necessary to give the pasta room to expand and cook without sticking to the pot. As a rule, granular cereals absorb more water than whole or flaked cereals. When too much water is used, dissolved nutrients are discarded with the excess water. The practice of rinsing whole grain cereals and pasta, such as rice and spaghetti, may prevent sticking of

the cooked product, but it also rinses away some of the water-soluble nutrients. Adding oil to the cooking water may help prevent pasta products from sticking together but also will cause the pasta sauce to slide off the pasta.

The amount of time required to cook cereals and pasta also varies. Fine-grained cereals like cornmeal cook faster than coarser ones like oatmeal. Small or thin pieces of pasta cook faster than large thick ones. Some cereals have been pretreated to cook faster. Smaller pieces cook faster because more of their surface is exposed to the heat and liquid. Cereals with little bran or cellulose cook faster than ones with large amounts. Whole-grain products require longer cooking time to soften the cellulose or fiber.

Cereals and pasta should not be overcooked or overstirred. Overcooking causes the product to become mushy, gummy, or thin. Cereals should be cooked until soft. Pasta should be cooked until tender but firm. Excessive stirring during cooking causes the product to become sticky. Stirring breaks the grains or pieces of the product and increases the amount of starch in the cooking water.

Microwave Cooking. No time is saved by cooking pasta in a microwave oven. Cooking pasta in the microwave oven should be avoided unless the pasta is cooked alone. If pasta is combined with other products, it is best to use the conventional method of cooking. When pasta is combined with another food and cooked in the microwave oven, the other food will usually cook much faster than the pasta, resulting in undercooked pasta and overcooked meat or other ingredients.

Starch as a Thickener. Starches used as thickeners in the preparation of foods include potato starch, cornstarch, tapioca, flour, and arrowroot. Starch granules contain a mixture of amylose and amylopectin. Amylopectin and amylose are starches and chains of glucose or sugar molecules. The proportion of

amylose and amylopectin in the starch granules determines the differences in cooking characteristics of the various starches. A high proportion of amylose allows the starch molecules to gel. A high proportion of amylopectin does not allow the starch granules to gel.

Flour or wheat starch is the most commonly used starch in food preparation. In addition to the wheat starch, flour also contains fats, protein, fiber, vitamins, minerals, and pigments, which cause the flour to form a translucent paste. It is used most often to thicken gravies, soups, and sauces.

Potato starch forms a translucent paste that is stringy and cohesive. The potato starch paste gels when cooled. It is used primarily in European puddings and matzo bread.

Cornstarch is available in two types known as regular and waxy. The regular type of cornstarch is that commonly sold in grocery stores. It is high in amylose and forms a gel. Regular cornstarch is used in puddings and often in fruit juices. The waxy type contains a high proportion of amylopectin and does not gel. It is used primarily for commercial food production for canning and freezing.

Tapioca is from the root of the manioc plant, a tuberous root plant found in South America and Florida. The roots of the plant must be ground to remove the starch. The starch is processed in a manner that forms the starch into small pellets called pearls which are later dried. These pearls give the tapioca its characteristic texture. Pearl tapioca must be soaked and cooked for long periods of time. Quick tapioca is gelatinized during the manufacturing process and requires less time to prepare. The starch paste formed is translucent and very stringy.

The arrowroot plant of the West Indies is the source of arrowroot starch. Its characteristics are similar to those of potato starch. Arrowroot is good for use in fruit sauces

because it leaves the sauce clear. Arrowroot starch will not brown, making it unsatisfactory in brown sauces or gravies. Arrowroot starch is used more often in Europe than in the United States.

Modified starches are starches that have been chemically or physically modified to make them suitable for use in the food industry. Pre-gelatinized or modified starches have been precooked, gelatinized, and dried. Water and sometimes water and heat are added to the starch to rehydrate it. Modified starches are used primarily in the food industry in convenience foods high in starch. Examples of convenience foods high in starch include instant mashed potatoes and instant puddings.

Baked Goods

To produce quality baked goods, one must have adequate ingredients for structure, liquid, a binding agent, a leavening agent, fat, and flavor. Ingredients most commonly used include the following:

- flour to provide structure
- milk or water for liquid
- eggs as a binding agent
- liquid, baking soda, baking powder, or air as a leavening agent
- butter, margarine, shortening, or lard as fat
- sugar, honey, molasses, or corn syrup for flavor



Baked goods are baked with dry heat. The oven temperature used must be exactly the temperature specified in the recipe. The baking process occurs when the heat from the oven causes the moisture in the product to steam and evaporate. The surface becomes

dry and forms a crust. As the temperature of the product continues to rise, browning occurs on the outside of the product first and then continues to the center of the product. Using an oven that is too hot results in a surface that dries and hardens before the product has been allowed to rise sufficiently. The surface continues to brown as the inside cooks. The result is a scorched crust.

An oven that is not hot enough results in a product that is not done. The batter or dough may dry out before it can brown. When the gluten is not cooked long enough to hold in the gas bubbles produced by the leavening agent, the product collapses. An oven that heats unevenly produces a bakery product that is cooked unevenly.



The pan or utensil that the product is baked in also is important. The size of the pan, as well as its condition, affects the final product. A utensil that is too small may result in the batter or dough overflowing the pan as it rises. A utensil that is too large results in a product that is flat and dry.

Most cooking utensils used with baked goods must be greased before the batter or dough is added. Some nonstick surfaces do not need to be greased. Greasing the utensil helps keep the product from sticking to it. The product used to grease the utensil can be one of the following:

- oil
- shortening
- nonstick spray
- unsalted solid fat

Some recipes may call for both grease and flour to coat the baking utensil. If any part of the product sticks to the pan, it endangers breaking up the whole product.

Angel food cakes or sponge cakes require a special pan. These pans should not be greased. The high egg white content in the cakes forms a delicate structure that must attach itself slightly to the thin sides of the pan. The grease would cause the pan to be slippery. The slippery side would cause the product to fall or collapse.

The oven door should not be opened during the cooking process. Each time the door is opened, the oven temperature is lowered. The cool air can cause the product to collapse.

The product should be removed from the pan according to the instructions on the recipe. Most products need to be removed immediately to prevent sticking. Some products may need to be allowed to cool slightly in the pan before they are removed. Exceptions include cakes without shortening (angel food and sponge cakes), quick breads, and some cookies.



Microwave ovens are primarily recommended for reheating bakery products rather than for cooking them. Quick breads can be cooked in a microwave oven, but the result will be a more compact product that does not brown on top. Yeast breads do not cook well in a microwave oven.

Pies and Pastries. Pies and pastries can be homemade or purchased frozen or premixed. Most of the frozen and premixed pies and pastries available today are of acceptable quality.

The basis of a pie or pastry is its crust. See Figure 12.5 for types of crusts. The crust is made from four basic ingredients:

- flour
- fat
- salt
- cold water

Types of Crusts

- Butter produces a weak, crisp crust with good flavor.
- Lard or hydrogenated shortening produces a strong, flaky crust with good flavor.
- Margarine produces a weak, crumbly crust with good flavor.
- Oil produces a weak, grainy crust; flavor can vary.

Figure 12.5

◆ Essential Questions: ◆ Factors Affecting Carbohydrate Cookery

1. What are the principles of starch cookery?
2. What is the process of cooking rice and pastas? Explain.
3. What is the most significant factor in producing a quality pie crust or pastry?

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Chapter Highlights

- ☆ Protein foods include eggs, meat, fish, poultry, legumes, cheese, and milk.
- ☆ When eggs are used as ingredients in a recipe, they contribute nutritive value; color, flavor, texture, and leavening; emulsifying; and binding capabilities. They also provide a coating for foods that are fried.
- ☆ The method of cooking fish depends on the type of fish being cooked, whether the fish is frozen or fresh, the amount of fat in the fish, and the preparation needed before cooking.
- ☆ Cheese protein, like egg protein, coagulates when heated and becomes tough and rubbery when overcooked. Cheese should be cooked at a low temperature for a short time.
- ☆ The goal when cooking fruits and vegetables is to retain the maximum amount of their original food value, color, flavor, and texture.
- ☆ Variety meats are more perishable than other meats and should be cooked soon after purchase.
- ☆ Poultry is the term used for domestic birds raised for food. The most commonly used types of poultry are chicken and turkey.
- ☆ Milk, like other animal protein, is sensitive to heat and should be cooked with as low a temperature as necessary for the shortest amount of time.
- ☆ The basis of a pie or pastry is its crust, which is made from flour, fat, salt, and cold water. A richer crust can be made by using eggs and sugar.
- ☆ Modified starches are those that have been chemically or physically modified to make them suitable for use in the food industry.

Chapter 13

The Use of Fats in Food Preparation



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 3E Apply the principles of food preparation to preserve quality and nutritive value of foods.



Chapter Vocabulary

acrid
butter
congealing point
fats
flavor
hydrogenation

melting point
monounsaturated fats
polyunsaturated fats
rate of rancidity
saturated fats
smoke point

FAT ABSORPTION IN FOOD PREPARATION

Fats and oils are the same substance — fat. Fats that are solid at room temperature are typically called *fats*. Fats that are liquid at room temperature are generally called oils. Fats and fat-like substances also are known as lipids.

Fats are used for various reasons in food preparation. Fats can be found naturally in various foods. Cheese and milk contain butter

fat. Nuts, meat, poultry, and fish contain fats as well. Fats also can be used in their pure form, such as cooking oils, for food preparation. Uses of fat include adding flavor or enhancing the flavor of other ingredients, keeping foods from sticking to each other and food utensils, tenderizing baked products, and providing a cooking medium for frying foods.

Fats used in food preparation come from two sources: plants and animals. Examples of fats from plants include the following:

- canola oil
- corn oil

- cottonseed oil
- olive oil
- peanut oil
- safflower oil
- sunflower oil
- tropical oils (coconut oil, palm kernel oil, and palm oil)



Fats from animal sources include the following:

- butter
- hydrogenated animal shortening
- lard

CLASSIFICATIONS OF FATS

Fats are classified as saturated, monounsaturated, or polyunsaturated. Fats in food are from one of these categories or a combination of the categories. The terms saturated, monounsaturated, and polyunsaturated refer to the amount of hydrogen in the chain-like chemical structure of fat. Saturated fats have the most hydrogen. Monounsaturated fats have less hydrogen, and polyunsaturated fats have the least amount of hydrogen. These differences affect the appearance of different fats at room temperature and their taste. The more saturated the fat, the more solid it is.

Saturated Fats

Saturated fats contain the most hydrogen of all the fats. Animal fats and tropical oils are the most saturated fats. Some are solid at

room temperature. Saturated fats are the tastiest of the fats. Saturated fats are in meats, butter, lard, coconut oil, whole milk, cream, ice cream, and egg yolks as well as in many processed foods, such as chocolate and cheeses. Saturated fat is most often used in convenience baking mixes.

Studies have shown a tendency for saturated fats to raise blood cholesterol levels. Cholesterol may cause health problems if there is an excess or a high level of it in the bloodstream. For individuals who have high cholesterol levels, it is recommended that they decrease fat intake, especially saturated fats.

Monounsaturated Fats

Monounsaturated fats contain less hydrogen than saturated fats but more hydrogen than polyunsaturated fats. They are typically liquid at room temperature. Most vegetable oils have a high percentage of monounsaturated fat. Monounsaturated fats can be found in egg yolks, lard, and vegetable oils.

Polyunsaturated Fats

Polyunsaturated fats are the fats most desirable in a person's diet. Safflower oil contains the highest proportion of polyunsaturated fatty acids. Peanut oil, corn oil, soybean oil, olive oil, and cottonseed oil also contain a high percentage of polyunsaturated fatty acids.

Linoleic acid is a polyunsaturated fatty acid that is essential for growth. Research has shown that it can help reduce the amount of cholesterol in the body and can reduce the risk of circulatory or heart diseases. It is an essential fatty acid because it cannot be produced by the body and must be supplied in the diet. Vegetable oils are the best sources of linoleic acid. Safflower oil is the richest. Corn oil, cottonseed oil, and soybean oil are good sources as well. Coconut oil has more saturated fat so it has less linoleic acid.



Sometimes manufacturers add hydrogen to oil, or hydrogenate it, to make it more solid at room temperature. For example, margarine and vegetable shortenings may be made from hydrogenated polyunsaturated oils. Adding the hydrogen increases the saturated fat. Hydrogenating a polyunsaturated oil transforms it into a monounsaturated or even a saturated fat depending on the degree of hydrogenation.

The approximate percentages of saturated, monounsaturated, and polyunsaturated fat in various fats are listed in Table 13.1.

◆ **Essential Questions:** ◆
Classifications of Fats

1. From what two sources do fats come?
2. Which vegetable oil is highest in saturated fat?

FATS USED IN FOOD PREPARATION

The types of fat used most often in food preparation are lard, butter, corn oil, olive oil, hydrogenated shortening, and margarine. All fats used in food preparation taste and feel greasy. They absorb strong odors and flavors from foods around them. They also become rancid when exposed to air.

Lard

Lard refers to the fat made from hogs. The composition and general characteristics of lard vary depending on the type of food the hog has eaten. Hogs that have been fed soybeans or peanuts produce a softer lard than those that have been fed corn. The part of the hog from which the lard is obtained also affects its composition and characteristics. The firmest fat comes from the fat covering the internal organs.

Lard is approximately 40 percent monounsaturated fat. It is relatively soft at room temperature yet firm when stored in the refrigerator. Lard is bland in flavor. It is often preferred as the fat ingredient for pastries because of the good flavor and flaky crust it produces when mixed with the other ingredients.

Butter

Butter is a very saturated fat made from cream. It is composed primarily of both saturated and monounsaturated fatty acids. Butter must have a minimum of 80 percent fat as regulated by the Food and Drug Administration. Approximately 40 percent of the fat is monounsaturated. Eighteen percent of butter is water. Butter is a good source of vitamin A. Other ingredients in butter include milk solids and usually color and flavoring. Butter absorbs odors very easily and should be stored tightly covered in the refrigerator.



Butter can be purchased with or without salt. Most butter is salted unless it is labeled sweet butter. Sweet butter is not salted. Unsalted butter is typically more perishable than salted butter; salt is added as a preservative.

Composition of Fats and Oils

	Cholesterol (mg/Tbsp.)	% Saturated	% Monosaturated	% Polyunsaturated
Canola oil	0	6	62	32
Safflower oil	0	9	12	75
Sunflower oil	0	10	20	66
Corn oil	0	13	24	59
Olive oil	0	14	74	8
Margarine, soft	0	14	32	31
Margarine, stick	0	14	39	24
Soybean oil	0	15	43	38
Peanut oil	0	17	46	32
Vegetable shortening	0	25	45	26
Cottonseed oil	0	26	18	52
Chicken fat	11	30	45	21
Lard	12	39	45	11
Palm oil	0	49	37	9
Beef fat (tallow)	14	50	42	4
Cocoa butter	0	60	33	3
Butter	33	62	29	4
Palm kernel oil	0	81	11	2
Coconut oil	0	87	6	2

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➡ **Table 13.1**

Because some fats contain other components in addition to fatty acids the sum of the saturated, monosaturated, and polyunsaturated may not equal 100 percent.

Oils

Oils refer to fats that stay liquid at room temperature and when refrigerated. Vegetable oils are often referred to as salad oils. They are almost 100 percent fat. The majority of oils come from plant seed while some come from the fruit of the plant. Coconut oil and olive oil come from the fruit of the coconut and olive plants. Soybean oil is typically the primary oil in products labeled vegetable oil. Other oils used in products labeled vegetable oil include the following:

- canola oil from rape seed found primarily in Canada
- corn from the germ of the corn grain
- peanut oil from peanuts
- soybean oil from soybeans

Oils, like other fats, make foods tasty, crisp, and tender. Oils have little flavor of their own, with the exception of olive oil. Olive oil has a distinctive flavor that is used often in salad dressings. Oils bring out flavors in herbs and spices, making them good for baking. Oils are good for frying or sautéing meats, poultry, and fish. Oils are preferred as the fat used to brush meats, poultry, and fish when baking or broiling.

As with other fats, oils absorb strong flavors and odors from foods around them. They also become rancid when exposed to air. The possibility of rancidity in oils is decreased when the oils are packaged in dark containers that protect them from light. Oils differ from other fats in the following ways:

- **congealing point** (temperature at which fat solidifies)
- **flavor** (taste)
- **melting point** (temperature at which a solid becomes a liquid)
- **rate of rancidity** (rate of deterioration)
- **smoke point** (temperature fat begins to burn or smoke)

Coconut oil is a highly saturated oil. It is also inexpensive. It is not uncommon for manufacturers to blend coconut oil with polyunsaturated oils that are more expensive, such as corn oil, olive oil, safflower oil, soybean oil, or cottonseed oil, to lower manufacturing costs. It is important to read labels in order to purchase products with pure corn, safflower, or other polyunsaturated oils. Fast-food establishments often use lard or inexpensive coconut oil for deep-fat frying.

Hydrogenated Fat

Hydrogenation occurs when hydrogen is added to the chemical structure of fat. A polyunsaturated fat can go through the process of hydrogenation and become partially or completely saturated. Hydrogenation increases a product's saturated fat content. Therefore, a product labeled "hydrogenated vegetable oil" contains saturated fat.

Shortening is made through the hydrogenation process. The fat used may be vegetable oil, animal fat, or a combination of the two. Air is whipped into the fat during hydrogenation to produce its creamy appearance. Chemicals also are added. The chemicals added to hydrogenated shortening help prevent oxidation and rancidity. They also increase the volume and moistness of the shortening.

Margarine

Margarine is produced as an alternative for butter. The two are similar in appearance, color, and flavor. Butter has more saturated fat than margarine. Margarine contains a minimum of 80 percent fat. It also contains vitamin A (retinol), as required by the Food and Drug Administration, and it may contain salt, whole milk, and nonfat dry milk. Soybean oil is the most commonly used fat in the production of margarine. Soybean oil is inexpensive and easily available.

Margarine can be purchased in several forms. The most common forms include:

- diet
- regular
- soft
- whipped

Varying amounts of linoleic acid are found in all margarines. A margarine made from partially hydrogenated polyunsaturated oil or fat is the most desirable. Those made from hydrogenated polyunsaturated oil are the least desirable.

Diet margarines contain less than 80 percent fat. Diet margarines have fewer calories than regular margarines. Approximately 50 percent of the fat in regular margarine is replaced with water in diet margarine.

Labels and advertising claims can be deceiving in regard to product content. A rule of thumb for judging the degree of saturated fat in a margarine is that the firmer the product, the higher the saturated fat content.

FRYING

Fat serves as a heat transfer medium when foods are pan-fried or deep-fried. Pan-frying allows the food to absorb some of the fat flavor while causing a brown crust to develop on the surface of the food. Foods fried in deep-fat have a golden brown crust and are crisp. The heat for deep-fat frying must be hot enough to quickly cook the food. If the temperature of the fat is too high, the food will be overcooked on the outside before the inside has enough time to cook completely. Temperatures that are too high can cause the fat to smoke. Very high temperatures can cause the fat to ignite. Temperatures that are too low increase the cooking time and cause the food to absorb excess fat. This results in a greasy product.

Fat that smokes or turns brown during cooking should be discarded. These are signals that the fat molecule is breaking down. Because salt breaks down fat, it is necessary to season foods after frying. When fat breaks down, it has an unpleasant odor and taste. This unpleasant odor and taste is often referred to as *acid*. The acid flavor that develops ruins the food and the oil. Both should be discarded. Foods cooked in fat at this stage of deterioration can cause irritation to the digestive system if eaten.

Smoke Points

The *smoke point* of fats refers to the temperature at which the fat begins to burn or smoke. Fat with a high smoke point should be used for deep-frying. Fried food should have a golden color and a crisp surface when done. This can only be accomplished when the correct type of fat is used at the right temperature. Fat with an acid or unusual flavor is bad and should not be used for any type of frying.

Different types of fat have different smoke points. Most foods do not require a frying temperature above 390°F. The fat used should have a smoke point that is 30°F higher than the temperature needed to cook a particular food. Vegetable oils have the highest smoke points followed by vegetable and animal shortenings. The smoke point of shortenings is lowered by as much as 100°F when emulsifiers are added. Emulsifiers typically used are monoglycerides and diglycerides. They have the ability to keep the fats suspended in the liquid so that they do not separate. Shortenings, butter, and margarine with emulsifiers have lower smoke points. This makes them more suitable for pan-frying foods. Diet margarines have a high water content, which makes them less suitable even for pan-frying. The water content causes the fat to splatter.

The smoke point of fats can be affected by the way the fat is handled. For example, a fat that has been handled or used repeatedly

has a lower smoke point than one that has not been handled or used. The smoke point is also lowered as the amount of food particles dispersed through the fat increases. An egg coating also lowers the smoke point and darkens the color of the fat.

Another factor affecting the smoke point of a particular fat is the type of utensil in which the food is fried. The smoke point of fat used in a wide, shallow pan with sloped sides is lower than the smoke point of the same fat used in a smaller pan with straight, vertical sides.

Butter and margarine have the lowest smoke points of any fat. They are best suited for low-heat sautéing. Butter and margarine should never be used for frying.

Oils and hydrogenated shortenings are quite suitable for use in frying because they have a very high smoking point. Olive oil should not be used in frying because it has a low smoke point. Lard also is suitable for frying foods.

Table 13.2 identifies temperatures to which various fats can be heated for deep-fat frying. The temperatures stated are slightly below the particular fat's smoking point. These fat temperatures are safe for frying foods. A thermometer should be used when deep-fat frying to determine and maintain the correct temperature for the particular fat being used.

Absorption of Fat

The browning that occurs during the frying process is a result of the temperature of the fat, the amount of time the food is cooked, and the structure of the food rather than the fat alone. The crispness of the crust is a result of the amount of moisture lost due to the heat. The lost moisture is replaced by the fat in which the food is cooked. The fat will tenderize the crust and add moisture and flavor to the food.

The amount of fat absorbed in fried food depends on a variety of factors. Those factors include:

- type of ingredient or food product
- temperature of the fat
- surface area of the food

The type of ingredient or food product affects the amount of fat absorbed by the ingredient. The higher the liquid, sugar, and leavening ingredients of a product, the greater the amount of fat absorbed. Due to its ingredients, a doughnut absorbs a greater amount of fat than a piece of chicken.

The temperature of the fat determines the amount of fat absorbed by the food product. The fat used must be heated to the appropriate temperature before the food is immersed. Failure to do so will result in more time needed to cook the food. The prolonged cooking time will make the food soggy and greasy. When cold foods are added to heated fat, the temperature drops.

Adequate time must be allowed between cooking batches to allow the fat to heat up to the appropriate temperature. Putting too much food in the heated grease at one time causes the temperature of the grease to drop and prolong the cooking time.

The surface area of the food also influences the amount of fat absorbed during frying. The larger the surface area exposed, generally the more fat that is absorbed.

Cooking Times

Cooking time for frying is affected by the type of food and its size. Table 13.3 represents general temperatures and times recommended for deep-frying various foods.

◆ **Essential Questions:** ◆
Fats Used in Preparation

1. How do saturated, monounsaturated, and polyunsaturated fats differ?
2. What four factors can affect the smoke point of a particular fat?
3. What three factors affect the amount of

Type of Fat	Temperature
Butter	Should not be used for deep-fat frying
Margarine	Should not be used for deep-fat frying
Shortening	350°F
Lard	360°F
Vegetable Oils	440°F

⇒ **Table 13.2**

Times and Temperatures for Frying Foods

Type of Food	Temperature	Minutes
Chicken	325°F to 350°F	10 to 15
Doughnuts	350°F to 375°F	1 to 3
Fish	350°F	3 to 6
French Fries	395°F	2
Meat	350°F	3 to 7
Vegetables	350°F to 375°F	3 to 5

⇒ **Table 13.3**



Chapter Highlights

- ☆ Fats and oils are the same substance.
- ☆ Uses of fat include adding flavor or enhancing the flavor of other ingredients, keeping foods from sticking to each other and food utensils, tenderizing baked products, and providing a cooking medium for frying foods.
- ☆ The three classifications of fat are saturated, monounsaturated, and polyunsaturated.
- ☆ Types of fat used most often in food preparation are butter, corn oil, olive oil, hydrogenated shortening, and margarine.
- ☆ The smoke point of fats refers to the temperature at which the fat begins to burn or smoke.
- ☆ The type of food and its size affect cooking times for deep-fat frying.
- ☆ Oils refer to fats that stay liquid at room temperature and when refrigerated.
- ☆ Hydrogenation occurs when hydrogen is added to the chemical structure of fat.
- ☆ The congealing point is the temperature at which fat solidifies.

Chapter 14

Influences on The World Food Supply



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 1C Relate cultural food patterns to personal health.
- 1D Analyze culturally diverse food choices that are nutritionally adequate.
- 11A Describe the relationship of good health and nutrition to job performance and relationships.
- 11B Explain the relationship of the food supply to quality of life.
- 12B Determine the demands placed on food science and technology by American societal patterns.
- 12C Describe technological, ecological, and sociological factors affecting world food supply.



Chapter Vocabulary

aquaculture
biotechnology
culture
ecological factors
economic alliance
famine
farm yields
food reserves

green revolution
malnutrition
postharvest technology
society
technological factors
tenure relationships

Providing food for the world's population continues to plague the leaders of both rich and poor countries. Hunger in developed and developing countries is a continual problem that must be addressed by the awareness and actions of citizens of the United States and other nations. Food issues and negotiations are of increasing importance in world politics and foreign relations. Worldwide trade has made the countries of the world dependent on one another. For example, the United States agricultural economy depends heavily on sales of agricultural food products to foreign countries.

Problems involved in feeding the world's people include the increasing population of the world, the conditions in developing countries, pollution, food taboos, insufficient protein sources in the food supply, and ignorance of nutrition and health information. Solutions to these problems involve politics, economics, societal behaviors, science, and technology.

MEETING THE NUTRITIONAL NEEDS OF THE WORLD

Many people believe that producing more food is the answer to the world food problem. The complex problems involved in providing food for the world population have been studied and researched by many sociologists, scientists, economists, and politicians. They have discovered that many factors are related to supplying food to meet the nutritional needs of the world. These factors include the following:

- increasing world food production
- nutrition education
- traditional value systems
- social organizations
- land ownership and tenure relationships
- political climate
- lack of income



- transportation and storage facilities
- customs, superstitions, and religious influence
- illiteracy

Increasing World Food Production

Eighty percent of people live in developing countries. The developing countries are the nations with severe economic problems that are working to become more industrialized. The developed countries are industrialized nations whose food production and supply can provide a sufficient standard of living for its citizens. The ability to produce enough food to feed growing population already exists. However, most of the food is produced in the more advanced and industrialized developed countries of the world.

The developing countries, whose agricultural and economic capabilities are limited, must increase food production within their own countries. They do not have the resources to import (to bring goods in from other countries) all the food that is needed for their growing populations. The developed countries will have to assist the developing countries in domestic agricultural reform, and the developing countries will have to work toward reducing the rate of population growth and increasing economic development that raises per capita income. Per capita income is the average amount of income for each person living in the country.

Postharvest technology is a major problem for the developing countries. **Postharvest technology** is the knowledge and resources to preserve and store food crops for future consumption. Even though some of the developing countries are able to produce food in sufficient quantities to feed their populations, they do not have the resources and technology for canning, freezing, and refrigeration to preserve the food for future consumption.

Nutrition Education

Lack of education concerning nutritional needs for good health is a factor in the many problems associated with hunger and malnutrition. Hunger or undernutrition is a state of weakness caused by the need for food. It occurs when the body lacks nourishment from any kind of food. Overnutrition is the intake of excessive amounts of food that leads to overweight and obesity. **Malnutrition** ("bad" nutrition) is the term that refers to either undernutrition or overnutrition. Nutrition education is important because often the food needed for a balanced diet is available, but people choose other items because they lack the education and information to make wise food choices. It is important for people to eat the right kinds of food to maintain good health.

The diets in developing countries are based on cereals and grains, lacking the protein needed for good health. People living on low incomes or in poverty need nutrition education to help them achieve a balanced diet from the food resources available.

Traditional Value Systems and Social Organizations

The world is made of people from many different cultures that have different attitudes and beliefs. Research shows that poverty is the main cause of hunger in the world. Many people tend to blame the citizens of developing countries for their poverty and hunger

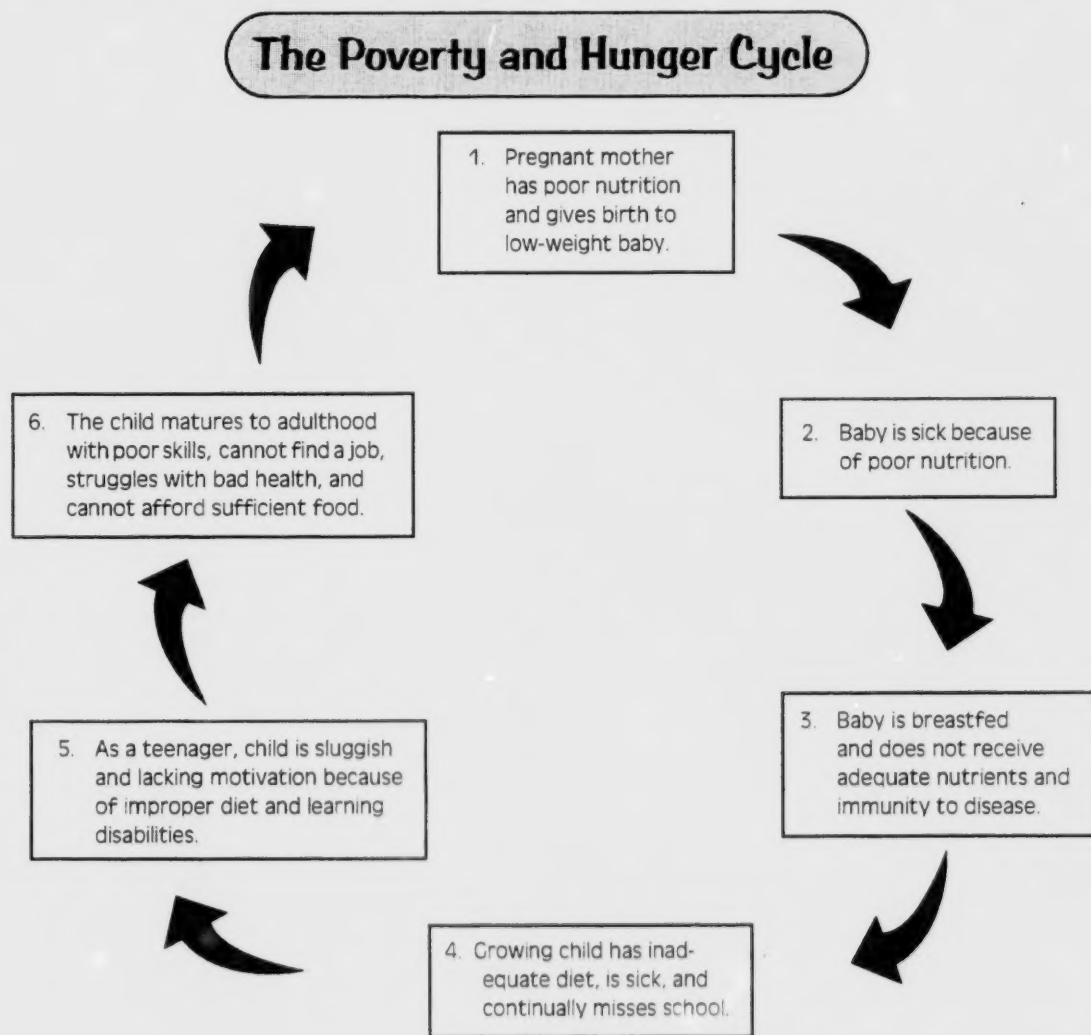
problems. They feel that if the poor had fewer children, there would be more food. It is true that when there are more people to feed, a smaller amount of food will be available for each one. However, for people living in poverty, having many children is a means of survival. The high infant mortality rates in developing countries mean that families can expect only a few of their children to reach adulthood. In those countries, children are needed to help earn extra income for the family and to take care of their parents in old age. It is a cycle. Poverty causes hunger, and hunger causes illness, lost wages, and more poverty. See Figure 14.1 for an illustration of the poverty and hunger and cycle.



Land Ownership and Tenure Relationships

One of the ways to combat hunger is for the developing countries to produce enough of their own food to feed the population. Food production in the United States far exceeds what is needed to feed American citizens. However, farmers in developing countries do not have the land, water, or resources to produce food in the same manner.

Many farmers in developing countries do not own their own land but instead work for a landlord for minimal wages. In many countries, tenure relationships exist between landowner and farmer. **Tenure relationships** are agreements between the landowner and the farmer whereby the farmer pays the landowner money, crops, or both in order to farm his land. Farmers who farm their own land face strict government policies that limit crop prices and reduce available credit. Fertilizer prices are so high that farmers cannot afford to use it. Agricultural education that would



⇒ **Figure 14.1**

help increase production is very limited or nonexistent in developing countries.

Political Climate

Many people feel that governments around the world have not made world hunger and malnutrition a priority. Very few countries have institutions or organizations whose goals are to end world hunger. Many developing countries do not place much em-

phasis on agricultural development; therefore, they fall behind in technology and production. In many poor countries, the government officials and politicians are not even aware of the hunger problems in their own countries. They exclude themselves from exposure to the poor people who have no political voice.

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Lack of Income

As mentioned previously, poverty and hunger are partners in a vicious cycle. Individuals and families who live in poverty face many overwhelming obstacles such as the following:

- lack of land on which to grow their own food
- lack of funds to purchase farm equipment if they do own land
- lack of funds to purchase nourishing food

Poverty and hunger cause illness and weakness that prohibit people from holding jobs that could produce income to buy food. Even in affluent countries like the United States, food and proper nutrition is continually linked to job performance. Sometimes people in developed countries have the knowledge and resources to choose healthy food choices but fail to act on them. Knowledge and behavior changes toward food can make a big difference in achieving a long and vigorous life as well as affect overall job performance. Making poor food choices can add to stress and stress-related health problems. Poor eating habits affect emotions making life conditions worse in the long run.

In contrast, following proper nutrition principles can reduce stress and enhance job performance. Numerous research studies have found productivity of employees greatly increased with healthy and timely eating patterns.

Transportation and Storage Facilities

Developing countries lack modern facilities for storing and distributing the crops they raise. The absence of modern farm equipment and supplies, poor roads, and limited access to trucks and other means of transportation inhibit the distribution of food. Poor storage conditions invite insects and pests that destroy a large percentage of harvested crops.

Customs, Superstitions, and Religious Influence

In every country in the world, different customs and traditions surround family life, including food habits and mealtimes. It is very important to consider the complex issues surrounding how customs, religions, and cultural habits influence food habits around the world. In many countries, the diet is mainly vegetarian. People in some countries may limit meat or animal products in their diet for cultural or religious reasons.

Superstitions about food products exist in many cultures of developing countries. People living in these cultures believe that consuming certain foods brings evil or hardship to a family. The people working with these cultures, such as Peace Corps volunteers or missionaries, must have an understanding of, and be sensitive to, the various customs and religious beliefs of the community.

Illiteracy

In the countries where the population continues to grow at a rapid rate, a large percentage of those reaching adulthood are illiterate. These countries do not have the funds or facilities to provide for education of the population. With the ability to read and write comes the ability to obtain better jobs and to learn about the importance of good nutrition and health. Even one educated person in a family could make a vast difference in the future of the young children and their nutritional health.



Education is not a number one priority with people who are starving. The developing countries must have overall economic development to include public education for their nation's children and illiterate adults.

◆ **Essential Questions:** ◆
Meeting the Nutritional Needs of the World

1. What are the factors related to supplying food to meet the nutritional needs of the world?
2. How does the poverty and hunger cycle affect the food available to families?
3. How is the quality of life and job performance related to good nutrition?

TECHNOLOGICAL FACTORS AFFECTING THE FOOD SUPPLY

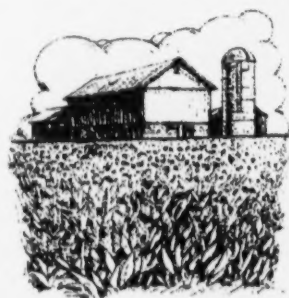
Science and technology continue to be important factors in finding solutions to world food problems. **Technological factors** are those factors that have been influenced by the advances in science and industry. Included in these advances are research and new developments in the following areas:

- agricultural capabilities
- food production
- food supply
- marketing
- biotechnology
- genetic engineering
- aquaculture

An investigation into these new trends can give people a better understanding of how to find solutions to the problems associated with feeding the world's population.

Agricultural Capabilities and Food Production

Of all the suggested methods for increasing the world food supply, the capability to increase the crop yields per acre and to introduce new nutrient-rich crops in cultivated areas seems to be the most satisfactory solutions. In a world where people possess the knowledge and technology to solve these problems, it only seems natural that this information should be applied to the world food supply.



One of the possibilities involves the introduction of food crops that could be cultivated in many areas of the world which are presently grown only in some remote areas. An example is the many varieties of potatoes that have different growth habits but could easily be grown in many parts of the world. New varieties of wheat, rice, and sorghum that yield two to three times as much grain per pound of fertilizer have been developed. The new rice has a very short growing season that enables farmers to plant and harvest as many as three crops a year on the same land.

Another new agricultural capability is the research involving the winged bean plant. This plant has been grown in Southeast Asia for many years. The winged bean plant grows well in different soils, even those found in tropical climates. This plant is completely edible and does not need to be fertilized during the growing season. It is much easier to

Winged Bean

In Africa attempts are being made to improve child nutrition in rural areas by means of a miracle Asian plant, the winged bean (*Psophocarpus tetragonolobus*). This plant is completely edible and rich in high-quality proteins. This remarkable bean could become one of the most important crops for developing countries because it offers a high source of protein.

⇒ **Figure 14.2**

grow than the soybean, and, when combined with corn, becomes a product with the protein equivalent of milk and provides a good source of vitamin A. See Figure 14.2. Research into new crops for developing countries is a step toward improving the world food supply.

The Food Supply

The food supply is all of the food that is available to the world's population. The demand for food increases with the increasing population. Ongoing research and new developments are important factors in planning for a future food supply that will be adequate to feed the people in the world. The world food supply depends not only on food produced during the current year but also on food reserves. **Food reserves** are the surplus products not consumed during previous years. These reserves are carefully stored so that they may be used at a later date.

Increases in the food supply can occur through greater farm yields. **Farm yields** refer to the output or amount of crops produced on a farm. Farm yields can be improved by the use of newer improved varieties of grains.

Some improved varieties require greater amounts of energy, fertilizer, and water than the other types of grains. The development of these high-yield grain varieties has been referred to as the **green revolution**. Some problems did arise as a result of the green revolution. Even though the developed countries could afford the additional water, energy, and fertilizers necessary to produce these high-yield grains, the farmers in the developing countries could not afford to purchase the high-priced seeds and the fertilizers. They also did not have access to the energy and water resources that were needed. Even though the purpose of the research that led to the green revolution was to develop grains that would increase crop yields in developing countries, it has been labeled unsuccessful because of the high cost and demand for unavailable resources.

Research scientists continue working to develop high-yield grains that have the same favorable characteristics but do not require the large amounts of water and fertilizers. Scientists are also trying to develop a grain that would resist insects and disease.

The development of new sources of food also contributes to increasing the food supply. Researchers are working with crops, such as coconuts, cottonseed, peanuts, and soybeans, to develop a food product from the protein-rich oilseed meal that is left after the oil has been removed. The possibility exists that these products would provide people in developing countries with an inexpensive protein food that could easily be grown in their own countries.

Marketing

Successful marketing of farm products requires food processing, storage, and transportation. These services are needed to distribute the food to the people in edible form and to provide storage for surplus reserves. Many losses occur due to insects, molds, pests, and spoilage. Technological



advances in controlling these problems reduce the amount of loss and thus make more food available. Advances in preservation methods also aid in reducing food losses due to spoilage. Improvements made in roadways and waterways in the developing countries can speed up the handling process and reduce losses from transporting food products. Efficient methods of storing and transporting available food products are major factors that contribute to the quality and quantity of the food supply.

Biotechnology

Biotechnology is a science that combines technology, engineering, and knowledge of biological systems to develop and improve agricultural processes, such as food productions. This information is used to develop new products and to solve problems related to humans and other living organisms. Biotechnology has made advances in the development of new foods and new food processing methods. The development of new food additives that have been biologically produced (produced in a laboratory) is a result of biotechnology. The development of inexpensive kits that can identify harmful microorganisms in food is a major contribution to food safety. Products such as new types of beef that are lower in saturated fat with the same flavor, protein, and texture as regular beef are results of biotechnology. This field has certainly opened up the possibilities for many new developments in the food industry.

Genetic Engineering

Genetic engineering is another area in which research and science lead to new developments and discoveries in the food industry. Genetic engineering is the transmission of genetic information that does not normally occur in nature into the cells of living organisms. For example, genetic engineering has been used to improve breeds of animals that produce a more desirable food product. Genetic engineering is responsible for the development of potatoes with an increased protein content. The advances in this area have opened new doors to the development of many nutritious foods with improved amino acid content and increased amounts of vitamins. Amino acids are the building blocks of protein and are essential for all living cells.

Aquaculture

Aquaculture is the cultivation of food organisms that can be raised in water. Along with fish and shellfish, some vegetables that have been grown successfully in water are considered aquaculture. This has become an important industry, not only because Americans are eating more fish and seafood, but because of the contributions to the food supply that it can make.

Fish and seafood products serve as the major sources of protein for many populations in the world. The ability to increase the amounts of these products through successful aquaculture is a factor in improving the world food supply. Aquaculture is discussed in more detail in chapter sixteen.

◆ **Essential Questions:** ◆
**Technology Factors Affecting
 the Food Supply**

1. How have technological advances in science and industry influenced the world food supply?
2. What are some problems faced by farmers in developing countries?

ECOLOGICAL FACTORS AFFECTING THE FOOD SUPPLY

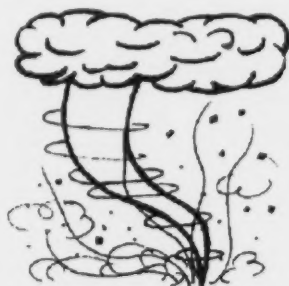
Ecological factors are the environmental factors that affect the world food supply. Natural and human-made disasters, climate, and soil have a tremendous effect on the quantity and quality of food available in different regions of the world.

Disasters

Throughout history, both natural and other disasters have caused food problems in the world.

Natural disasters, such as droughts, earthquakes, famines, and floods, seriously impact the food supply in the nations affected. Other disasters, such as wars, also can affect the food supply. Misuse of natural resources can have a disastrous effect on a small country's food supply.

One way to prevent mass starvation, hunger, and death in these affected countries is through international relief efforts in which many countries work together to aid the



stricken nation. To provide disaster relief, there must be adequate storage of food reserves to meet the increased demands for food. Technological advances in reducing food losses due to spoilage and pests during storage have helped to increase the food reserves. New and more efficient methods of transporting food also have enabled the relief efforts to be more successful. These cooperative relief efforts require the coordination of the aiding countries. The relief efforts are arranged by organizations, such as the Food and Agricultural Organization and the United Nations.

Climate

The climate of a region in the world affects the agricultural capabilities of that region. For example, tropical climates create ideal growing conditions for rice. Corn grows better in subtropical or temperate regions. One of the reasons for the bountiful food supply and successful agricultural production in the United States is the moderate climate.

Changes in weather patterns can cause changes in precipitation that bring about crop failure. These changes in precipitation can cause floods or droughts that completely destroy the crops in a region. Famines in China and India were directly related to crop failures caused by weather. A **famine** is a severe shortage of food that causes serious illness and death from starvation.

Soil

The world food supply is affected by two factors: the amount of suitable land available for cultivation and land management. Even though a large amount of suitable land exists in Africa, the expense of clearing, controlling disease, irrigating, and leveling makes it not worth the cost. Agricultural authorities believe it is better to work to improve crop production on land that is already developed. Soil mismanagement is another problem affecting the quantity and quality of the food supply. It

is estimated that inadequate land management is responsible for approximately 2.5 million acres of land used for crops in the developing countries being unsuitable for agricultural production. In the United States alone, valuable topsoil is lost every year due to wind and water erosion.

◆ **Essential Questions:** ◆
**Ecological Factors Affecting
the Food Supply**

1. How can natural disasters affect the food supply?
2. What is the relationship of climate and soil to quantity and quality of the food supply?

SOCIAL FACTORS AFFECTING THE FOOD SUPPLY

Along with the technological and ecological factors, social and cultural factors affect food consumption around the world. Societal, cultural, and religious laws have great influence on all aspects of food consumption.

Societal and Cultural Food Patterns

Society refers to a group of people who share a common culture and live within a common region. **Culture** refers to the beliefs, traditions, and values that are shared by the people within a society. Culture refers to the ideas, traditions, skills, and arts that are passed from one generation to the next. In the American society, citizens depend on advances in science and technology to continually improve the way food is produced, harvested, and transported. However, within the American society, there are subcultures that restrict the use of certain types of food. For example, the Amish culture restricts the use of advanced technology in producing,

harvesting, or transporting food for the Amish people.

In the United States, many people avoid horsemeat, insects, raw fish, and algae, which are all acceptable as food sources in other countries. Some cultural patterns evolve over time; for example, chop suey is an American dish based on a Chinese style of cooking.

Within all societies, many different cultural traditions affect food consumption. In some instances, governments restrict the import or production of certain foods due to cultural or religious beliefs. In most societies, food is used as a symbol of love, affection, and social ties to family and friends. In many societies within the developing countries, certain rituals surround the gathering, preparing, and serving of food. These food traditions serve to strengthen family and social relationships.



Many factors influence the foods people eat. What we eat, when we eat, and with whom we eat are heavily influenced by the culture and society we live in. Food does more than satisfy our physical nutritional needs. Food patterns and customs meet cultural, social, and psychological needs as well.

Cultural Influences

All Americans are members of an ethnic group. An ethnic group refers to a group of people with common racial and/or cultural characteristics, such as religion, national origin, language, or tradition, which make them a distinct subgroup of society. Many people are part of more than one cultural group, especially in the United States, because immigrants came from Europe, Asia, Africa, India,

and other countries to live in America. The result is a great salad bowl or a multicultural society. Each group influences the choices of foods and the variety of preparation methods common in the United States.

Cultural influences in America are many and varied. The original settlers brought foods that were native to their homelands. The Italians brought pastas and rich tomato sauces. Hungarians brought goulash spiced with paprika. The Chinese contributed stir-fry dishes, and Germans brought sausages.

The factors that influence food choices fall under two categories shown in Figure 14.3. The cultural factors that influence food choices may be very different from person to person or group to group.

For centuries, food has been used as trade for economic and political reasons. Even in remote areas of the world, tribal societies exchange food products that benefit the members of each tribe. Food is used as a gift to strengthen social ties, and it is used between countries as an economic alliance. An **economic alliance** is a close association or relationship between countries to economically support one another through the sale of goods and services. In political circles, food is used before and after meetings with international leaders to relieve the tension often associated with politics.

In all societies, food has been used to distinguish social class and to symbolize wealth and prestige. The cultural beliefs, traditions, and values of people within societies determine the customs surrounding food is used.

Religious Influences

Religious beliefs within societies influence the many rituals and customs surrounding food. Some societies believe that avoiding certain foods protects them from harm. Some

religions have customs surrounding the consumption of certain foods during religious holidays or special holy days. Many religious ceremonies are accompanied by feasts with family members and friends. In the United States, religious ceremonies, such as baptisms, weddings, and funerals, are usually followed by a gathering involving food. Nutritionists and dietitians know that to honor a person's cultural or religious foodways honors and respects the person.

Social Influences

Foods, as well as eating patterns, have many social implications. Not only do people associate food and mealtime with social gatherings of family and friends, but they also associate certain foods, occasions, locations, and people with eating. Many people have childhood recollections of going to a family member's home, such as their grandparent's house, for a special meal. Likewise, other people associate food with times of celebration and crisis. In cultures all over the world, people prepare and serve food as part of most social gatherings.

Food choices and food preferences are also influenced by friends and peer pressure. Friends may encourage others to try new foods or new preparation techniques. Often, food is used to boost self-esteem in the presence of friends or as a means to feel included in a certain group. Young people, especially, are influenced toward food choices that are "popular" foods among their peers. However, these food choices often are not necessarily nutritious ones.

It is important that nutrition educators consider all of these factors when helping children and adolescents acquire good dietary habits that will carry over into their adult lives. Students who learn decision-making skills and have a good self-concept are more likely to be able to make food choices based on nutritional knowledge rather than on peer pressure.

Internal and External Influences on Food Choices

Many factors influence food choices. These factors fall under two broad categories: internal influences and external influences. The factors that influence food choices may be very different from person to person or group to group.

Internal Influences

Physical Needs

- hunger
- nutritional requirements
- activity level
- general health status
- energy level

Psychological Needs

- appetite
- emotions or feelings
- body image
- attitudes

Personal Food Preferences

- taste
- smell, color, texture of food
- associations of food with positive or familiar activities

Knowledge of Nutrition and Healthy Eating Practices

External Influences

Food Availability

- family choices
- growing seasons
- food production facilities
- food distribution channels

Advertising Claims

- more energy
- better athletic performances
- improved health
- better self-image

Social Settings

- family mealtime
- school lunches
- parties
- movies
- sporting events

Society and Culture

- ethnic traditions
- religious beliefs
- family traditions
- peer preferences
- family patterns and routines

Individual and Family Income

- what foods people can afford today

Time of Day

- being accustomed to eating at a certain time of day

Adapted from American Cancer Society, *Changing the Course*, (K-12 Nutrition Curriculum) Columbus, OH.

⇒ **Figure 14.3**

Psychological Influences

For most people, food has emotional value that is influenced by intrinsic and extrinsic factors. In infancy, food fulfills the need for security and relieves the tensions and anxieties brought on by hunger. Babies learn to connect food with the warmth and security provided by the person who feeds them. Children associate birthday cake with pleasurable experiences at a party or popcorn at the movies. Enjoying the flavors and aromas of food in the company of loved ones is psychologically pleasing. Food appeals to the senses of taste, sight, and smell. It also appeals to the need for social contact.

Many people use food in an attempt to satisfy their feelings of sadness, loneliness, or a deep emotional shock. Emotions often cause undereating and overeating. Overweight people often find comfort in foods they like and can satisfy other emotions like anger, frustration, or inadequacy by eating certain foods.

In addition, the media (advertising, movie theaters, spectator sports, and television programming) sends emotional signals to eat certain foods. Advertising convinces consumers that everyone is trying the product or that life will be more worthwhile after eating or drinking this food or beverage. Often the way the food is packaged sends emotional messages that causes consumers to buy and eat a product. Emotions have a tremendous effect on our food choices.



Current Trends

Current trends also impact the foods people eat and how they eat them. Consider the influence of trends on food selection in our society as shown in Figure 14.4.

In our society today, individuals have many opportunities for cultural diversity in food selection and availability. The variety of cultural groups in the U.S. brings new choices to the table. The media has introduced food choices different from traditional food patterns, and new innovative packaging and transportation technology exposes consumers to various cultural food patterns that makes food selections as diverse as the planet we share. Whether we follow familiar food traditions or embrace new and different cultural ones, sound nutritional standards and guidelines still apply.

◆ Essential Questions: ◆ Social Factors Affecting the Food Supply

1. How can religious beliefs affect food choices?
2. What current trends have an impact on food consumption? Explain.
3. What is the relationship between food and nutrition and the quality of life?

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Current Trends Affecting Food Choices

- Decrease in the number of meals families eat together.
- A change in who prepares meals, and with more women working outside the home, there is less time for meal preparation.
- Modern technology and rising incomes affect food habits.
- Increase in number of meals eaten at fast food establishments that may not be as nutritious and healthy.
- More people living alone prompts food manufacturers to offer single servings and smaller portion foods.
- The way people spend leisure time affects food patterns. Snack foods are popular, and foods like pizza and sandwiches are delivered to homes now more than ever.
- Cooking gives some individuals a creative outlet, and it has become very trendy to experiment with new recipes and cooking methods.
- Cooking magazines and television programs are influencing preparation methods and food selection.
- An increase in number of dual-family incomes has greatly influenced family meal patterns.
- An increase emphasis on fitness has prompted many to seek out low-calorie and reduced-fat foods.
- Eating ethnic foods has become very popular.

⇒ *Figure 14.4*



Chapter Highlights

- ☆ Hunger in developed and developing countries is a continual problem that must be addressed by the awareness and actions of citizens of the United States and other nations.
- ☆ Poverty and hunger are partners in a vicious cycle. Poverty and hunger cause illness and weakness that prohibit people from holding jobs that could produce income to buy food.
- ☆ Per capita income is the average amount of income for each person living in the country.
- ☆ Tenure relationships are agreements between the landowner and the farmer whereby the farmer pays the landowner money, crops, or both in order to farm his land.
- ☆ Nutrition education is important because many times the food needed for a balanced diet is available, but people choose other items because they lack the education and information to make wise food choices based on nutritional needs.
- ☆ Natural and other disasters, climate, and soil have a tremendous effect on the quantity and quality of the food supply.
- ☆ The world food supply depends not only on food produced during the current year but also on food reserves.
- ☆ Efficient methods of storing and transporting available food products are major factors that contribute to the quality and quantity of the food supply.
- ☆ Postharvest technology is the knowledge and resources to preserve and store food crops for future consumption.
- ☆ The cultural beliefs, traditions, and values of people within societies determine the customs for how food is used.

Chapter 15

Nutrition From A Global Perspective



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 11C Explain how the long-term effects of hunger affect a society and world progress.
- 11D Contrast the nutrition in developed and developing countries.
- 12A Analyze factors that influence the food chain, pricing, and choices.
- 12D Explain the roles that world food trade policies and governments play in world progress related to nutrition.
- 12E Describe international organizations dealing with world food supply and contributing to improved nutrition.
- 12F Analyze the problems of world hunger.
- 12G Predict possible solutions to the problems of world hunger.



Chapter Vocabulary

advocate	General Agreement on Tariffs and Trade (GATT)
commodity foods	GOBI
demand	International Policy Council on Agriculture, Food, and Trade (IPC)
developed countries	marketing
developing countries	oral rehydration therapy (ORT)
dietary mainstays	processing
farm subsidies	production
food chain	poverty
food industry	supply
food system	
food technology	
food web	

Food and nutrition have aroused interest since the time of primitive man. Prehistoric man had to hunt for wild plants and animals in order to have food. Agricultural skills and the domestication of animals provided a dependable food supply for early civilization.

All food originates from plant, fish, or animal sources. The origin of food can be linked to the location where the food is grown, developed, or manufactured. The natural environment is a key factor in food origins. The availability of water, type of land, and climate conditions affect the growth or development of food.

THE FOOD CHAIN

The **food chain** is the system in which matter and energy are transferred from organism to organism in the form of food. Plants make up the base of the food chain. Thus, they are known as the primary food source. Plants transform solar energy to food by a process called photosynthesis.

The function of the food chain is to supply food to the organisms at all levels. The food chain has five levels which include:

1. Seeds are planted.
2. Plants grow.
3. Animals eat plants.
4. Man eats animals and plants.
5. Food supplies man with nourishment to plant more seeds.

Food chains often form what is known as a food web as a result of organisms eating more than one type of plant or animal. A **food web** is the linkage of organisms to one another by their dependence on each other for food. Figure 15.1 illustrates the food web.

Economics and the Food Chain

Food is a product of worldwide trade. The amount of food that can be produced is affected by economic, political, and technological factors. The food chain is important to the United States economy because the United States is considered a worldwide leader in food exports and in food production for consumption by its own citizens. Many countries in the world depend on the United States to supplement food supplies for their populations.

The types of food that make up food chains vary in different parts of the United States as well as in different parts of the world. Land, water, energy, and a desirable climate are all necessary for the successful function of the food chain. As a result of various climates and environments, different parts of the country produce different types of food. For example, wheat is produced in Kansas, and oceanfront cities supply fish and seafood products.

Harvesting losses and diseases, as well as the country's economic and political situation, are factors that influence the food chain. Drought or crop disease can cause a major interruption in the food chain. When the food chain is interrupted in the major food producing countries of the world, food availability and the nutritional well-being of the world population are affected.

It is important for governments and individuals to recognize that the food chain is fragile. In government controlled economies, the government dictates the amounts and kinds of foods that are produced. In countries with free economies, however, supply and demand as well as government subsidies and taxes control food production.

Individuals can help the world food situation by the choices they make that affect the food chain. By reducing the intake of processed foods, consumers conserve land,

world population differ greatly among the developed and developing countries.

Dietary mainstays are the foods that provide the main nourishment and are the most available in an area. **Developed countries** are those industrialized nations whose food production and supply can provide a sufficient standard of living for its citizens. Developed countries in our world include the United States, Europe, USSR, Japan, Australia, and New Zealand.

The term **developing countries** includes those nations that are working to become more industrialized as well as those nations with severe economic problems. Africa, Asia, and Latin America are developing countries whose populations suffer from poverty, hunger, and malnutrition. At one time, the countries with an inadequate food supply were referred to as less developed countries. Now, the nations of the world are divided into two categories which are the developing and developed countries.

Grain is the dietary mainstay for many people in the world. Unrefined grain products, such as rice and corn, supply the main source of food energy for developing nations. Oats, rye, sorghum, and millet are grains that provide the basic nourishment in many countries. Potatoes and other home and farm grown vegetables are also part of the basic diet in developing countries.

As nations become more industrialized, the dietary habits of the people change. A larger percentage of the diet is animal and highly processed foods, and a much smaller percentage is grain products. In developing countries, grain is consumed directly as cereals and grain products. The diets of people in developing countries who consume these products lack the nutritional balance they need for good health.

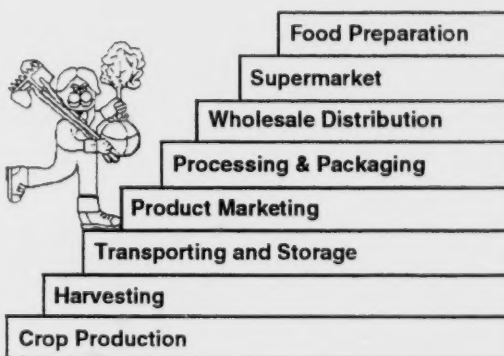
When the main source of nutrition is grain and grain products, the diet is deficient in energy, protein, and calcium. In developed nations, people consume grain indirectly. The animals eat grain and then the animals supply meat, milk, and eggs for people. When the dietary mainstay is animal products and highly processed foods, the diet tends to lack vitamin A, vitamin C, vitamin B₆, magnesium, zinc, and dietary fiber.

From Farm to Family

Whether from the farm, ranch, or sea, a chain of producers, processors, manufacturers, government regulators, and retailers work to provide consumers with the food products they need and desire.

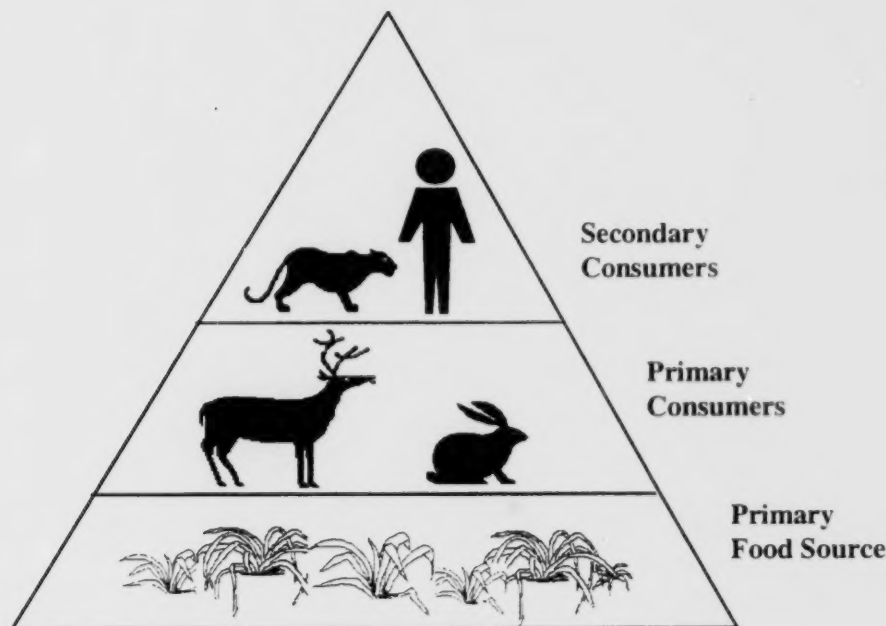
The **food system** includes the steps a food item goes through until it reaches the supermarket shelf. Figure 15.2 illustrates the specific steps that a food item progresses through from the point of growing in the field until being served at a meal.

Steps in the Food System



⇨ **Figure 15.2**

Food Web



⇨ *Figure 15.1*

resources, and the energy needed to manufacture these foods.

One of the major factors affecting food chains is the costs involved in producing food at higher levels of the food chain. Included in these costs are fuel expenses, labor in production and processing, and technology in refining and manufacturing food products.

The lowest costs of food production occur at the plant stage. When plants are consumed as food, the higher levels of refining, processing, and packaging are avoided.

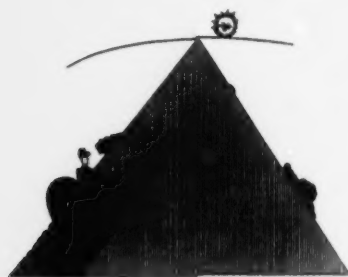
At each level of the food chain, more resources are needed to produce the food. Therefore, as the food selection moves to a higher level on the food chain, the cost of delivering that food to the consumer is increased.

◆ Essential Questions: ◆ The Food Chain

1. What is the primary function of the food chain?
2. Why is it important to the United States economy?
3. How are costs of food related to the level of the food chain?

FOOD FOR THE WORLD

Even though many differences exist in the diets of the global population, one factor is certain: all people need food for survival. Foods that are the dietary mainstays of the



The business operations involved in the production, processing, and delivery of food to consumers is known as the **food industry**. Figure 15.3 shows the process food goes through from the producer to the consumer. Consumers can be assured of safe, high-quality food products because of government standards the food industry must meet. The five main branches of the food industry are the following:

1. production
2. processing
3. packaging
4. transportation
5. marketing

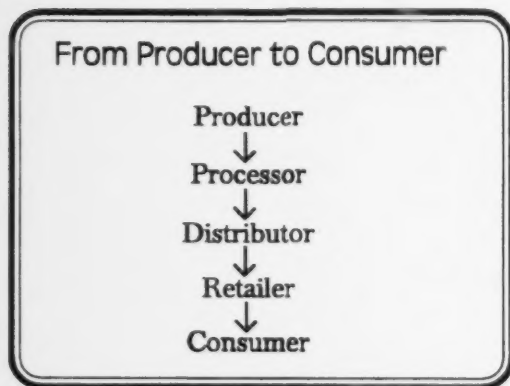


Figure 15.3

The food industry is a very complex system. As consumers demand more highly processed and specialty foods, the complexity of the food industry increases. During the last three decades, the growth of food technology has brought an increasing number of processed convenience foods to the supermarket shelf.

Food technology is the science of adapting scientific methods directly or indirectly to food production, processing, and handling. Due to the increasing number of women in the work force and active lifestyles, the major emphasis in food technology is convenience. United States consumers are demanding quality food items that require a minimum amount of preparation at a reasonable cost. This demand also has increased the variety of imitation food products because of their lower costs.

Environmentalists demand food packaging that is safe and recyclable. Changes in plastic foam containers and aluminum cans are just a few examples of technology. Health experts want to see more foods that reflect sound nutrition guidelines such as low fat and low salt. Many current issues affect the food industry and ultimately, the cost to the consumer.

All of these factors add to the complexity of the food industry. Each additional step in the food system increases the costs in terms of processing, energy usage, packaging, and labor. While people in developing countries seek basic foods to meet health and nutritional needs, citizens of developed countries continue to demand foods that are higher in the food chain.

The food system in the United States is more complex today than it was at the beginning of the twentieth century. Not only have food consumption patterns changed, but technological advances in food storage, food preservation, and food production methods have provided consumers with food products

year round. The improved efficiency of the food transportation system also has added to the complexity of the food system. Fresh, refrigerated, and frozen foods are shipped across the United States and throughout the world.

Consumers in the United States are able to have the best food supply in the world for several reasons. The United States lies geographically in a temperate region. The temperate regions in the world are those that are located between the tropics and the polar areas. These regions provide soil and climate conditions that are excellent for farming. Also, most American farmers utilize proper production practices that allow them to produce large crops. In addition, the nation funds agricultural research that not only solves problems associated with agriculture, but also supplies farmers with up-to-date research information and development discoveries. The United States and the other developed countries have populations that grow more slowly than the food supply.



◆ **Essential Questions:** ◆
Food for the World

1. What is the difference between developed and developing countries?
2. What is food technology? How has it impacted our society?

FOOD AND THE CONSUMER

As consumers in the United States enjoy a quality and variety of food the rest of the world does not know, the food industry continues to expand and improve the food supply. As marketing and production costs increase, so do food prices. However, Americans still pay less for food than any other country in the world. Only 12 to 14 percent of available income is spent on food.

Numerous factors affect food prices. These factors can be grouped into three areas including factors that affect production costs, factors that affect processing costs, and factors that affect marketing costs.

Production is the raising of crops and animals for food. The factors that affect production costs include farm expenses, crop size and quality, and weather conditions. **Processing** includes the cleaning, trimming, grinding, cooking, canning, freezing, baking, dehydrating, freeze-drying, and packaging of food. The costs for raw materials, packaging materials, labor, overhead, government regulations, and transportation and storage of food are included in the processing costs. **Marketing** refers to the costs of getting food to the consumer, such as advertising and selling. These costs are influenced by inflation, taxes, advertising costs, losses due to spoilage, shoplifting, and consumer demand.

Food prices are affected by supply and demand. **Supply** refers to the amount and availability of a food product. **Demand** refers to the consumer's desire to purchase a given item at a certain time. In the food industry, as in other industries, the price of the product (food) is directly related to supply and demand. As the supply of a food product increases, the price decreases. On the other hand, if the supply is limited, the price increases. If the demand for a product rises, so does the price of that product. However, if the demand drops, the price drops.

A definite relationship exists between the price of food products and supply and demand. In the United States, farmers have often produced surpluses of grains and other major crops. The surplus of a food product lowers the consumer price because the demand is lessened. However, the lower prices reduce farm income so much that it forces the farmer out of business.

Foreign trade demands for United States food products increase the need for farmers to expand production. In the long term, these actions increase food costs for urban consumers. When farmers are encouraged to expand foreign markets, they increase production of crops. This results in expanded foreign sales which forces the prices of those products to go up. As Japan, Western Europe, and other developed nations demand increasing amounts of U.S. food products, prices the United States consumer pays will continue to rise.

Reducing Food Costs

There are many ways consumers can reduce the cost of food for their families. Preparing food at home, rather than purchasing convenience food products, is one of the main ways to cut food costs. Examples of food preparation techniques that cut costs include making yogurt, granola, baby food, bread, and mixes at home.



Not all home-prepared foods are less expensive than those prepared commercially. Some hidden costs in home prepared food items are the costs of time, energy, labor,

containers, and equipment. There are also some disadvantages to preparing some foods at home. Individuals who balance careers and family may not have the time and energy required to prepare many foods at home. Home-prepared foods may have a shorter shelf life, the quality or taste may not be as acceptable as the commercially prepared item, and the cost may actually be higher. It is important to weigh all of these factors when comparing the costs of home prepared versus commercially-prepared foods.

One method of controlling food costs and reducing food waste is learning ways to use foods wisely in meal preparation and planning meals carefully. Food costs may be reduced by using coupons and by taking advantage of weekly supermarket specials. Commercial food processors control costs and reduce waste through careful selection of crops, meat, fish, and poultry and by exercising close control over food processing.

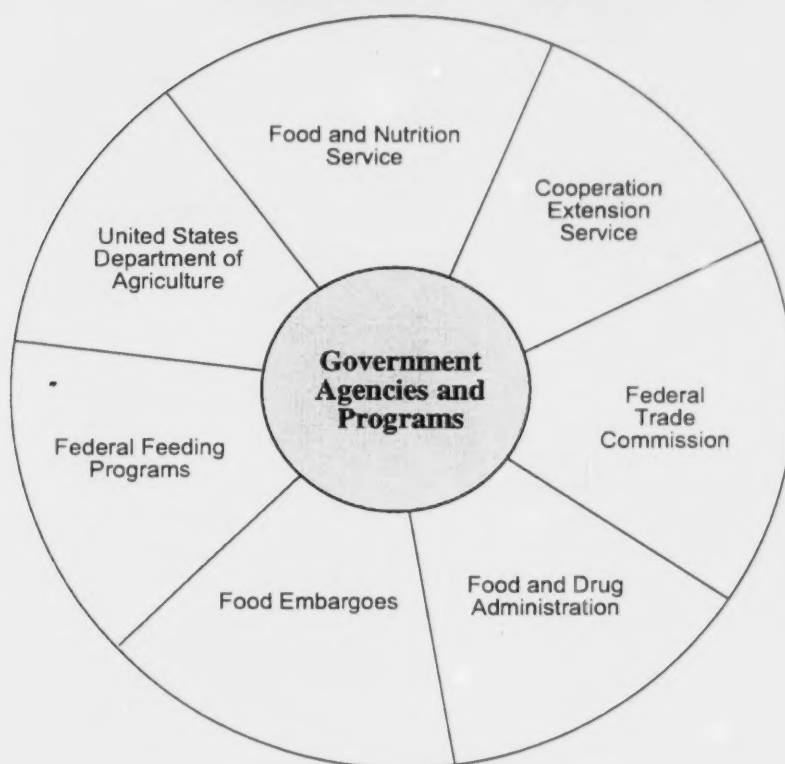
Many fruits and vegetables are damaged as the result of poor weather or growing conditions. A freeze or drought can damage an entire crop and make supplies of a particular item limited. This limited supply then causes the price to go up. A freeze in the orange grove may cause the damaged oranges to have to be made into orange juice. As a result, the prices of all orange products will increase.

Government Agencies

Government agencies are involved with the aspects of food that concern consumers. These agencies work to assure consumers of a safe food supply and to protect them against fraud in advertising and labeling. Figure 15.4 shows many government programs related to protecting our food supply.

The *United States Department of Agriculture (USDA)* is one of the largest departments of the federal government. This department supervises programs and services that involve farmers and consumers, such as

Protecting Our Food Supply: Government Agencies and Programs



⇒ Figure 15.4

food stamps for low-income families; farm price supports; loans to farmers; soil conservation; agricultural research; grading and inspection of meat, poultry, and eggs; crop forecasting and insurance; and foreign trade of agricultural products. The USDA is made up of approximately twenty agencies that administer these government programs and services.

The *Food and Nutrition Service* of the USDA directs the School Lunch Program, the Food Stamp Program, and the Food Distribution Program. All of these programs provide low-income families access to low-cost food.

Another agency within the USDA is the *Science and Education Administration*. This agency is involved in research, extension services, and teaching in areas of food and agricultural sciences. Many consumers depend on extension agents from the *Cooperative Extension Service* as resources for current information and assistance in agricultural production, and family and consumer sciences. The extension agents also work within communities to provide programs and services related to youth (+H), community, and rural development. The *Cooperative Extension Service* serves rural and urban citizens.

The *Federal Trade Commission (FTC)* works to protect consumers from false or deceptive advertising. The FTC regulates the use of words in advertising that make health and curative claims. Claims are often made in advertising for products that are supposed to improve health or provide cures for people with diabetes, hypertension, obesity, high cholesterol, heart disease, or other health problems. The FTC investigates these forms of advertising and controls fraudulent sales promotions.

The *Food and Drug Administration (FDA)* is a branch of the United States Department of Health and Human Services. It was established in 1906. The major responsibilities of the FDA are to regulate and enforce standards of safety for the food, drug, and cosmetic industry. They also are responsible for controlling food labeling to protect consumers against fraud.

The functions of the FDA include the following:

- Develop nutrition labeling regulations.
- Investigate and regulate the use of food additives.
- Establish standards of identity for certain foods. Standards of identity specify the ingredients and amounts of ingredients that must be included in standardized foods.
- Define the use of the word "imitation" in identifying food products.
- Establish nutrition quality and fortification guidelines. Fortification is a process of increasing the nutrient value of a product by adding another ingredient to it, such as vitamins and minerals.
- Inspect food processing plants.
- Test products for pesticide residue, radioactive elements, toxic metals, and other undesirable elements.
- Publish warnings to the public if hazardous food products are found.

Many government programs influence the domestic food supply. Some of these government programs include farm subsidies, price supports, food embargoes, and federal feeding programs. **Farm subsidies** are monetary payments or other forms of aid that the federal government gives to farmers in order to control farm production and prices. This aid can be in the form of money, free land, tax relief, or legal rights. The federal government attempts to keep farm prices from falling below a certain level through price support programs. The government establishes minimum prices for key agricultural products and then purchases these products from farmers if the market price should fall below the established minimum level. The government then uses these food products for public aid and disaster relief programs.

Food embargoes are government orders that prohibit the movement of food products into or out of the country. In 1980, the United States restricted the sale of grain and other goods to the USSR in protest of the Soviet invasion of Afghanistan. During a U.S. food embargo, merchant ships carrying specific food or agricultural products are not allowed to enter or leave U.S. ports.

Federal feeding programs are projects and services that provide low-income families the opportunity to receive meals and food products free or at a reduced price. Included in the federal feeding programs are the National School Lunch and Breakfast Program, the Food Stamp Program, WIC (Women, Infants, and Children), Congregate Feeding Programs for senior citizens, and the commodity distribution program.

Alternative Food Sources

If all the grocery stores, food retailers, restaurants, and fast-food chains closed their doors, consumers would search for ways to obtain adequate food for their families. Consumers should be knowledgeable about alternative food sources within their communities.

Smart consumers make wise food selections by choosing foods that provide the most nutrition for the money spent. Alternative food sources other than the retail supermarket include farmers' markets, home gardening, roadside stands, and food cooperatives. These alternative food sources can provide the consumer with a variety of nutritious foods at lower prices.

Farmers' markets allow farmers to sell their produce directly to the consumer. Some communities have large open-air markets where local farmers can display their produce. The consumer can buy fresh, quality produce, but the consumer should be aware of the prices of the same items in the supermarket. At a farmers' market, the consumer has the advantage of bargaining with the farmer about the price. Some disadvantages to farmers' markets include the following:

- foods are only available when they are in season
- food products are not graded or inspected
- the variety of food is limited

Home gardening provides the consumer with an alternative to retail food buying. Home gardens can reduce family food costs, especially if large quantities are grown and preserved for the winter months. This provides many families with a year round supply of fruits and vegetables. The home gardener can plant a variety of fruits and vegetables. Home gardening involves work and the possibility of failure. Careful planning and regular attention to the home garden can greatly reduce the risk of failure.

During the growing seasons, roadside stands are found along highways in some farming communities. Roadside stands are much smaller than farmers' markets, because usually only one or two farmers have fresh produce to sell. Depending on the amount of consumer trade in the area, the prices can be considerably lower than those in the supermarket. Many consumers like to purchase

produce from roadside stands because they can select garden fresh fruits and vegetables.

A food cooperative, or co-op, is an organization of people (usually neighborhood residents) who buy food products in bulk at prices lower than the retail supermarket. The co-op buys the food wholesale and the members divide the purchases and share in the savings. Food cooperatives are effective only if they are well organized and well managed. The food selection is limited to those products that are the food choices of the majority of the members.

◆ **Essential Questions:** ◆
Food and the Consumer

1. What factors influence food prices? Explain supply and demand.
2. How are government agencies involved with the aspects of food in the United States? Give three examples.
3. How can consumers reduce the cost of food for their families?
4. What are some examples of alternative food sources?

HUNGER AND MALNUTRITION

Hunger and malnutrition are problems that have faced the world throughout the history of civilization. For many years, it was believed that the problems associated with hunger and malnutrition were due to overpopulation and insufficient food production. However, it is now believed that the cause of hunger and malnutrition is poverty. **Poverty** is a standard of living in which there is not enough income to provide for basic needs such as food, clothing, and shelter.

The United States, as well as other countries, also faces the hunger and malnutrition problem. Malnutrition is related to stunted growth, low-birth-weight babies, infant mortality and other serious health problems. Research shows that one in every ten persons worldwide experience hunger at some level.

Many organizations exist for the purpose of fighting hunger in the world. World food trade policies affect how food is distributed to the hungry people throughout the world. The problems of hunger, malnutrition, and poverty must be addressed through a greater awareness by politicians and citizens.

International Organizations

Many organizations work worldwide and within the United States toward finding solutions to the problems of hunger. Some of these organizations operate through governments or international agencies. Others are funded by public donations. Each of these organizations works toward achieving these basic goals:

- to improve the nutritional health of impoverished individuals
- to raise the standard of living
- to improve the efficiency of food and agriculture production
- to improve the distribution of food and agriculture products
- to better the conditions of rural populations

Food and Agriculture Organization.

The Food and Agriculture Organization (FAO) was established in 1945 as an agency of the United Nations (UN). The FAO organizes research and program development for topics that affect the world food supply. The headquarters for the FAO is in Rome, Italy. The members of the FAO include approximately 160 countries. Some of these countries are UN member nations and some are not.

The FAO works primarily in developing countries to improve agricultural production,

use of soil and water resources, nutrition, and agricultural technology. WHO and FAO convened the International Conference on Nutrition (ICN, Rome, 1992).

Through this process, the major forms of malnutrition were assessed, their causes and contributing factors were characterized, and strategies and responsibilities for reducing malnutrition were identified as a basis for concerted national and international action. The World Food Summit (Rome, 1996) reiterated and reinforced the validity of these goals and strategies. Figure 15.5 is the document generated at the World Food Summit.

The FAO also works internationally to provide a stable market for agricultural products and with other organizations such as the World Bank and the World Health Organization.

World Health Organization. The World Health Organization (WHO) is an agency of the United Nations that was founded in 1948. Its purpose is to promote good health for all people of the world through the direction and coordination of international health work. WHO offers services in training health workers, controlling disease, improving the health of mothers and children, working toward better sanitation, and encouraging good mental health. One of the primary functions of WHO is to prevent disease through effective health systems.

WHO currently has approximately 165 member nations. It is governed by the World Health Assembly, which is made up of delegates from all the member countries.

The section of WHO responsible for examining the program plans and the budget is known as the executive board. The World Health Assembly selects twenty-four countries to appoint a delegate to the executive board. The executive board also is responsible for investigating any situation requested by the assembly.

World Declaration on Nutrition

▲ As a basis for the Plan of Action for Nutrition and guidance for formulation of national plans of action, including the development of measurable goals and objectives within time frames, we (the Ministers and Plenipotentiaries) pledge to make all efforts to eliminate before the end of this decade:

- Famine and famine-related deaths.
- Starvation and nutritional deficiency diseases in communities affected by natural and man-made disasters.
- Iodine and vitamin A deficiencies

We also pledge to reduce substantially within this decade:

- Starvation and widespread chronic hunger.
- Undernutrition, especially among children, women, and the aged.
- Other important micronutrient deficiencies, including iron.
- Diet-related communicable and noncommunicable diseases.
- Social and other impediments to optimal breastfeeding.
- Inadequate sanitation and poor hygiene, including unsafe drinking water.

Nine action-oriented strategies

- Incorporating nutritional objectives, considerations and components into development policies and programs.
- Improving household food security.
- Protecting consumers through improved food quality and safety.
- Preventing and managing infectious diseases.
- Promoting breastfeeding
- Caring for the socioeconomically deprived and nutritionally vulnerable.
- Preventing appropriate diets and healthy lifestyles.
- Assessing, analyzing, and monitoring nutrition situations.

Source: *Goals of the World Food Summit* (Rome, 1996).

⇒ *Figure 15.5*

The third part of the WHO is known as the secretariat. The secretariat is headed by a director general and is made up of all WHO workers around the world. The organization's headquarters is in Geneva, Switzerland, and there are six regional offices throughout the world.

Food Assistance Organizations in the United States.

Many organizations provide food assistance for hungry people in the world. In the United States, federal food programs were organized to decrease the incidence of hunger and malnutrition in the country. Other privately funded organizations work to meet the needs of hungry citizens in communities across the United States. As the developed countries of the world realized the magnitude of the world hunger problem, food assistance programs were organized to provide aid to developing countries.

U.S. federal food programs are programs administered by the Food and Nutrition Service of the United States Department of Agriculture. Government assistance for farmers or for those suffering from hunger and malnutrition did not begin until after the Great Depression of the 1930s. Food assistance programs began with the first federal food stamp program in 1939. This first program was very complex and was abandoned in 1943. The food stamp program that now exists was started in 1961 during the Kennedy administration.

In the late 1960s, research studies showed such an enormous incidence of hunger and malnutrition in America that the food stamp program was expanded and other food assistance programs were started. Various federal food assistance programs in the United States are described as follows:

- ***Food Stamp Program***

This program provides food stamps for low-income families. The food stamps may be used at grocery stores to purchase food

items. There are restrictions on which items may be purchased. Criticisms of the food stamp program include the argument that food stamp recipients do not always purchase nutritious food items and that the program is not administered efficiently. The Food Stamp Act of 1977 helped to alleviate some of these problems by providing accountability of items purchased.

- ***School Lunch Program***

The National School Lunch Program was started in 1946. This program allows public and private schools to provide nutritious lunches for school children at a low cost. The school lunch programs are subsidized, and economically disadvantaged children can receive lunch free or at a reduced price. The school cafeteria must abide by federal nutritional guidelines that require that the meal provide one-third of the Recommended Daily Allowance (RDA) for certain nutrients.

- ***School Breakfast Program***

The school breakfast program was established in 1966 under the Child Nutrition Act. This program was designed to work with the school lunch program to provide children with two-thirds of the RDA for certain nutrients. Although not as many children participate in the school breakfast program as the school lunch program, the program has been considered successful because of the improved nutritional status of the children who have been involved in the program.



- **Women, Infants, and Children (WIC) Supplemental Food Program**

The WIC program was established in 1970 to provide health education, nutritional supplements, and preventive health care to women, infants, and children up to age five. Participants in the program must not only be economically disadvantaged but also considered nutritionally deficient. The WIC program has been successful in reducing infant mortality, low birth weight, and complications associated with pregnancy.



- **Commodity Food Distribution Program**
Surplus foods are distributed through the USDA. **Commodity foods** are surplus food products that are stored as a result of farm price support programs. These surplus food products are distributed to low-income families and elderly citizens on fixed incomes.

- **Expanded Food and Nutrition Education Program**
This program is a federally funded nutrition education program for low-income families. This program is administered by the Cooperative Extension Service in each state. Expanded Food and Nutrition Education staff members work with homemakers in small groups to teach nutrition, food buying, and food preparation skills. Most of these homemakers use commodity foods that they receive from the Department of Human Services. This program also offers a youth program that teaches young people nutrition education and food preparation skills.

Food Assistance Programs in Other Countries

Many food assistance programs provide food to people in needy countries of the world. The food aid given to other countries by the United States is organized and administered by the Food for Peace program. The Food for Peace program provides farm products from the United States to developing countries such as those in Africa, Asia, or Latin America. Most of these products are commodity products such as grain or grain products. Sometimes the food products are sold; other times the food is donated. The USDA directs the Food for Peace program. The secretary of agriculture decides which products are available to be exported to the countries in need.

The UN and the FAO sponsor the World Food Program. The *World Food Program* accepts donations from developed countries throughout the world and then distributes the food to the countries in need. Many private charitable organizations in the world work to supply food and agricultural assistance to countries with a limited food supply.

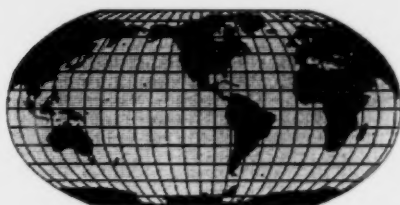
Food for Progress

The USDA-administrated Food For Progress program assists developing countries and emerging democracies "that have made commitments to introduce or expand free enterprise elements in their agricultural economics through changes in commodity pricing, marketing, input availability, distribution, and private sector involvement." Food for Progress agreements can be signed with governments or with private voluntary organizations.

United Nations International Children's Emergency Fund (UNICEF)

Children are the focus for this organization. Through sponsors, UNICEF distributes

protein-rich foods. October is international UNICEF month for promoting and raising money for children who live where food and clean water are inadequate.



World Food Day

World Food Day (WFD) is October 14 annually. Every year, new information related to world hunger, food safety, water, and other topics are addressed.

◆ Essential Questions: ◆ Hunger and Malnutrition

1. What factors contribute to hunger in the world?
2. What are three organizations working toward finding solutions to world hunger problems? Describe how these organizations work toward solving world hunger problems.

NUTRITION AND WORLD PROGRESS

There is enough food produced to feed all the people of the world. Food assistance organizations offer aid, but there are still hungry and malnourished people in the world. In order to understand why, it is important to investigate the world hunger problem. It is also necessary to examine world food trade policies and how they impact the problem of worldwide hunger and malnutrition.

As previously mentioned, the World Food Summit met in Rome in November 1996 and focused the world's attention of the chronic problems of hunger and malnutrition. The United States, along with 185 other countries, pledged to reduce the number of food insecure people by half—from over 800 million today to no more than 400 million by the year 2015.

The World Hunger Problem

The problems associated with hunger cannot be attributed to any one cause or factor. Sociologists and scientists agree about some of the factors that contribute to malnutrition and hunger in the world. These factors include the following:

- cultural and religious food issues
- disasters
- food reserves insufficient in densely populated countries
- inequality of food supply and demand
- insufficient water supplies
- lack of adequate nutrition and health information and education
- poverty
- soil erosion
- war and political unrest
- fuel shortages

All of the causes of hunger and poverty are intertwined. Combined with all the factors listed is the fact that businesses and governments control the management of the economies of the nations in the world. Decisions affecting world food issues are made by these two powers. Figure 15.6 lists facts that illustrate the reality of world hunger today.

Solutions

Leaders of the world continue to look for solutions to the world hunger problem. When the total problem is broken down into smaller problems, the possibilities for solving the problems seem more attainable. Many programs have made advances in solving some of these problems.

Facts about World Hunger

- About 24,000 people die every day from hunger or hunger-related causes. This is down from 35,000 ten years ago, and 41,000 twenty years ago. Three-fourths of the deaths are children under the age of five. *Source: Hunger Project, United Nations*
- Today 10% of children in developing countries die before age of five. This is down from 28% fifty years ago. *Source: CARE*
- Famine and wars cause just 10% of hunger deaths, although these tend to be the ones you hear about most often. The majority of hunger deaths are caused by chronic malnutrition. Families simply cannot get enough to eat. This in turn is caused by extreme poverty. *Source: The Institute for Food and Development*
- Besides death, chronic malnutrition also causes impaired vision, listless-ness, stunted growth, and greatly increased susceptibility to disease. Severely malnourished people are unable to function at even a basic level. *Source: United Nations World Food Program (WFP)*
- It is estimated that some 800 million people in the world suffer from hunger and malnutrition, about 100 times as many as those who actually die from it each year. *Source: Food and Agriculture Organization of the United Nations (FAO)*
- Often it takes just a few simple resources for impoverished people to be able to grow enough food to become self-sufficient. These resources include quality seeds, appropriate tools, and access to water. Small improvements in farming techniques and food storage methods are also helpful. *Source: OXFAM*
- Many hunger experts believe that ultimately the best way to reduce hunger is through education. Educated people are best able to break out of the cycle of poverty that causes hunger. *Source: United Nations Children's Fund (UNICEF)*

Source: www.thehungersite.com

⇒ Figure 15.6

A protein-rich flour called Bennimix was developed in Sierra Leone in West Africa to supplement the diets of infants and children. *Bennimix* is a flour made from rice, benniseed (a variety of sesame seed), and peanuts. Malnourished children began to thrive when Bennimix was added to their diets.

In Nepal, a similar product was created by mixing soybeans, corn, and wheat. This "superflour" was used to make porridge, which was fed to malnourished children and their mothers. After ten days of supplementing their diets with the porridge, the mothers and children had gained weight, and their overall general health was improved.

The United Nation's Children's Fund (UNICEF) developed a plan for reducing the number of child deaths from hunger and malnutrition. This plan is part of UNICEF's Child Survival campaign entitled GOBI. **GOBI** is an acronym for the four parts of the child survival campaign. These parts include growth charts, oral rehydration therapy, breast milk, and immunizations.

The four areas have been identified as critical to this program. The growth charts are given to mothers with children in developing countries and in some parts of the United States. The mothers are taught to weigh their children every month and to detect the early signs of malnutrition that can cause retarded growth, development, and death.

The oral rehydration therapy (ORT) was developed to counteract the damaging effects of starvation and malnutrition. These children do not actually die from hunger or malnutrition but from the severe health problems these conditions create. The children suffer from severe diarrhea caused by bacteria and infections. The diarrhea causes dehydration, which leads to life-threatening health problems.

The **oral rehydration therapy (ORT)** consists of giving the children a solution of salt, sugar, and water that mothers can prepare. The mothers are taught the proper proportions to use. This solution counteracts the weakening effects of the diarrhea.

Breast-feeding is being promoted in developing countries because of its many important health benefits. Breast milk is sterile and nutritious and provides the infant with important immunities. UNICEF's efforts to provide children with immunizations against diseases such as diphtheria, measles, polio, tetanus, tuberculosis, and whooping cough will certainly have an effect on the child mortality rate in developing countries.

Many different organizations work with food policy issues. These agencies provide factual information about the current status of world food policies and topics. The following are international hunger-relief organizations:

- Bread for the World Institute
- Center on Hunger, Poverty, and Nutrition Policy
- Freedom from Hunger
- International Labor Organization
- OXFAM America
- Seeds of Hope Publishing
- UNICEF, United Nations International Children's Emergency Fund
- FAO, United Nations Food and Agriculture Organization
- WHO, World Health Organization
- World Hunger Program
- Worldwatch Institute

One person can make a difference if working in conjunction with one or more of these organizations. Becoming involved and becoming an advocate is the first step. An **advocate** is a person who speaks out on behalf of a problem. Advocates for the hungry and

poor can take definite steps to ending the hunger issue.

- Volunteer to fix food for a needy family.
- Provide garden space for growing vegetables.
- Educate others about hunger in your community.
- Get involved by writing government officials concerning hunger policies.
- Donate money to hunger relief organizations.
- Volunteer your time at a local food pantry.

Each individual can find ways to be part of the solution. Balance and conservation are critical in using the world's resources effectively.

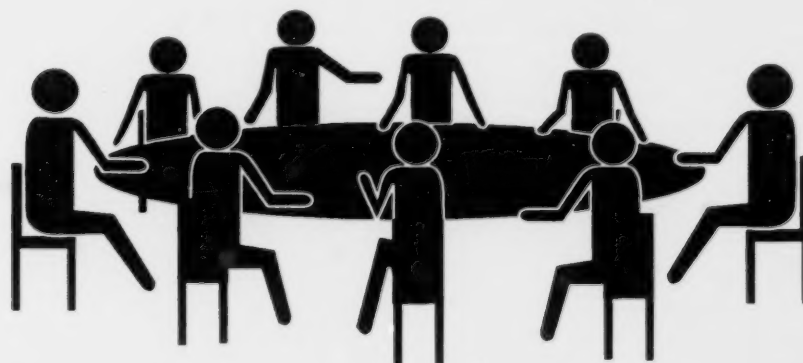
World Food Trade Policies

As part of the study of world hunger and food policy issues, it is important to understand the role of world food trade policies. Although worldwide trade has grown rapidly since 1900, the leading exporting countries have virtually remained the same. The top three leading exporting countries include the United States, West Germany, and Great Britain. The top fifteen leading exporting countries export about 70 percent of the total world exports. These same countries also seem to be the world's largest producers.

A large volume of the trade between countries occurs with countries in the same geographic region. For example, approximately two-thirds of Canada's exports go to the United States, and in turn, Canada is one of the United States' largest customers of exports. This same pattern exists in western Europe and in the communist countries.

Nations are free to establish their own regulations regarding foreign trade. However, in 1947, the ***General Agreement on Tariffs and Trade (GATT)*** was signed by twenty-three countries. The GATT is an agreement that allows for a nondiscriminatory approach to world trade policies. Each country's trade problems and conflicts are worked out cooperatively with the other participating nations.

Most of the developed or industrialized nations try to protect their agricultural products from foreign imports. This is a way of encouraging domestic production. The United States is a large exporter of food products because it is also one of the world's largest producers.



**International Policy Council on
Agriculture, Food, and Trade (IPC)**

The *International Policy Council on Agriculture, Food, and Trade (IPC)* is dedicated to developing and advocating policies that support an efficient and open global food and agricultural system—one that promotes the production and distribution of food supplies to adequately meet the needs of the world's growing population while supporting sound environmental standards. See Figure 15.7 for the mission statement of the IPC.

◆ **Essential Questions:** ◆
Nutrition and World Progress

1. How is would trade related to world hunger?
2. Why do developed countries want to protect their agricultural products from foreign imports?

**The Mission of the
International Policy Council
on Agriculture, Food, and Trade**

The IPC was founded in 1987 as independent group of leaders in food and agriculture from 20 developed and developing countries, including formerly centrally planned countries. Members are chosen to ensure the Council's credible and impartial approach, and include influential leaders with extensive experience in farming, agribusiness, government and academia. The IPC meets twice annually to develop policy recommendations to address the critical issues facing the world's agricultural system. It then conveys its recommendations directly to policymakers through its personal contacts and through a variety of papers and studies. The IPC also convenes task forces and holds conferences and seminars.

Source: International Policy Council on Agriculture, Food, and Trade

➤ **Figure 15.7**

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Chapter Highlights

- ☆ The system in which matter and energy are transferred from organism to organism in the form of food is known as the food chain. The function of the food chain is to supply food to organisms at all levels.
- ☆ Food is a product of worldwide trade. The amount of food that can be produced is affected by economic, political, and technological factors.
- ☆ Dietary mainstays are the foods that provide the main nourishment and are the most available in an area.
- ☆ Developed countries are those industrialized nations whose food production and supply can provide a sufficient standard of living for its citizens.
- ☆ The term developing countries includes those nations that are working to become more industrialized as well as those nations with severe economic problems.
- ☆ Food technology is the science of adapting scientific methods directly or indirectly to food production, processing, and handling.
- ☆ The FAO works primarily in developing countries to improve agricultural production, use of soil and water resources, nutrition, and agricultural technology.
- ☆ The International Policy Council on Agriculture, Food, and Trade (IPC) is dedicated to developing and advocating policies that support an efficient and open global food and agricultural system.
- ☆ In the United States, federal food programs were organized to decrease the incidence of hunger and malnutrition.
- ☆ The purpose of the World Health Organization is to promote good health for all people of the world through the direction and coordination of international health systems.
- ☆ One of the primary functions of the WHO is prevention of disease through effective health systems.

Chapter 16

Advances in Food Science and Technology



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 9A Determine the effects of technological advances on food availability.
- 9B Interpret how consumer choice is influenced by market research and marketing in the field of food science.
- 9C Summarize the relationship of entrepreneurial opportunities, technological advances, and marketing research.
- 9D Determine the effects of advancements in food science and technology on family strengths and the welfare of the family.



Chapter Vocabulary

advertising
cell fusion
direct store delivery
(DSD)
food brokers
gourmet boutique
hybrids
hyper-markets

intermediate moisture foods (IMF)
polyculture
proximate analysis
Universal Product Code (UPC)
warehouse shopping
wholesalers
Veri-Green process

The process by which food products arrive at the dinner table today is different than the process used fifty years ago. The food industry is greatly influenced by economical trends, technological developments, and

lifestyle changes. Food technology is involved in the total sequence of food production from raw materials to processing, preservation, and distribution.

ADVANCES IN FOOD TECHNOLOGY

Foods, just as clothing, go in and out of style. People are very health conscious today, and the trend is away from eating heavy meat and potato meals and toward eating low-calorie, low-fat meals. Technology has greatly influenced the ability to determine the nutrient content of foods and the ability to make food products more nutritious.

Research has increased in the food science industry. Basic chemical and physical principles have become the foundations of food science and nutrition and the nation's food supply. Certain professionals have specialized in the development of new food items for the average consumer as well as for the commercial foodservice industry.

Lifestyle changes related to food include the importance of the following:

- taste, freshness, and variety
- convenience foods
- natural foods
- price/value
- lower fat and cholesterol
- lower calories
- lower salt

Foods available today come in a variety of forms, such as:

- canned
- dehydrated
- dehydrofrozen (frozen and dehydrated)
- freeze-dried
- raw/fresh
- frozen
- individually quick frozen (IQF)
- microwavable
- partially prepared
- packaged dry mixes
- ready-to-serve
- retort packages

The shelves at grocery stores are often full of new and improved products. Many of

these are semiprepared and prepared food products developed to shorten preparation and/or cooking time.

Food Packaging

Determining the appropriate packaging for a product is a complicated task. Every food product is unique. Packaging that works for one product does not necessarily work for another. Today's market demands convenience and quality for both the packaging and the product.

Food packaging used to be a relatively simple, uncomplicated task. Today, food packaging also serves as a food marketing tool and advertising tool. Its goal is not only to keep the food it surrounds fresh, but also to capture the attention of consumers and encourage them to buy the product. With more than 12,000 products on grocery store shelves, competition among food products is at an all-time high. Packaging has become extremely important.

A significant amount of research and time goes into the selection of a package cover. The packaging must be appropriate for the food it holds, and the package cover design must be attractive to the customer. Packaging costs can be as much as 30 to 40 percent of the final product cost.

Several steps are involved in product packaging selection. Scientists, researchers, technicians, and chefs are all involved. The first step in developing the right packaging is to identify materials used successfully on similar products. Materials often include cellophane, different types of plastic wrap, and foil. The product is then wrapped in various packages, weighed, and placed in rooms that maintain different temperatures and humidity levels.

The products are weighed in their packaging after a specified amount of time to determine the amount of moisture lost. If a product weighs less after two weeks, then the

packaging is less than effective. The packaging is altered and the product is placed in the controlled rooms and tested again.

The packaging selection process also includes food tasters who sample the food after the products have been tested in controlled rooms. The products are sampled to determine how the packaging materials affect their taste. The process continues until the right packaging formula is determined. The next step is to determine the type of seal to use, the type and color of ink to use on the package, and the opening and closure of the package.

Few of the new products found on the market today are packaged in cans or glass containers. New products are primarily packaged in containers made of laminated polymer films or plastics. Some packages are made with as many as seven layers of paper, polymer, and thin metal films. With flexible packaging come many concerns about safety and durability. The following represent some concerns about flexible packaging:

- microbial contamination
- contamination from the polymer product
- reduced shelf life
- damage to the seal of the package

New Products for the Foodservice Industry

Demographic trends (characteristics of a population) have a significant impact on the foodservice industry. A slower population growth is predicted for the coming years implicating a more intense competition for customers in the industry. Racial and ethnic diversity is growing and forcing the industry to target menu offerings, provide a broader range of ethnic foods, and offer more diversity in food products in general. Marketing will become increasingly important in the years to come.

Consumers are looking for foods that are low in fat, low in calories, fresh, flavorful, convenient, and high in fiber. Foods such as seafood, oat bran, and broiled or baked chicken are items they seek. At the same time, consumers still want foods such as candy, cookies, and ice cream. Some of these foods now contain fat substitutes and salt substitutes. In this respect, the foodservice industry is meeting customer demands and trends by developing healthier versions of food products which may look and taste the same as the previous version.

Food industry research indicates that consumers are snacking more than in the past, but they want to feel as though they are snacking less and that the foods they are snacking on are healthier. Miniature-sized snacks, single serving products, and smaller portion sizes of higher calorie meals are some of the ways the industry is responding. The name of the product also influences the consumer's perception of the product.

With more women in the work force and the shift in the age of the population, the convenience food market has grown rapidly. Consumers want fast foods, finger foods, microwavable items, and self-serve food items. Popular products include chicken fingers and nuggets, potato skins, mini-pizzas, egg rolls, and fajitas.

In restaurants, consumers want quality, variety, moderate prices, and nutritionally superior foods. Basic menu items include simple meats, poultry, and fish. Even pizza restaurants are meeting customer demands by developing "light" pizzas that contain less fat and salt than regular varieties. Other consumer demands include extended hours and convenient food delivery.

Vending machine choices also have been influenced by health trends as well as consumer's desires for quality products, variety, and moderate prices. Most individuals identify quality with trusted brand names.

Vending machine companies are meeting this demand by placing name brand snacks in their machines. Cold drinks, hot drinks, and various snacks are common in vending machines. The growing demand for microwavable products also has influenced vending machine companies. Microwave popcorn is probably the most common microwave food available in vending machines today. Microwavable dinners are processed in vacuum-sealed packages, or retorts. These are also being developed for sale in vending machines.

Food technology has responded to the needs and demands of society. Consumers dictate the areas where research and technology respond in food science. Many advances have resulted in improved pricing, nutritional value, quality, and convenience. However, advancements in technology have some negative influences on the family unit. For example, family experts suggest that the families who eat a meal together on a regular basis strengthen their relationships. This time together lends itself to better communication and family harmony. With fast food and modern technology in food preparation, some families have stopped eating sit-down meals together and eat on the run, which could break down lines of communication and threaten the total welfare of the family unit. With new advances in food technology both positive and negative results are evident.

Technological Advances in Agriculture

It is estimated that only 2 percent of the population of the United States are farmers. Only a small percentage of the farms are family operated. Food production has become a large scale business. Technological advances have had major impacts on the farming industry with new methods of irrigation, breeding of plants, and test-tube breeding of cows. Technology is expensive. Few family farm owners can afford the high costs of the latest technology.

Food production is known less as agriculture and more as agribusiness. Agribusiness (turning conventional agriculture into a business) allows a higher percentage of quality products to be produced and creates higher yields with a more efficient use of natural and human resources.

Genetic manipulation of cells has been around for hundreds of years. It is now known as genetic engineering. It is probably the oldest form of plant breeding. Early farmers saved the seeds from their best plants and used them for replanting the following year. The plants that produced the largest yield and had the greatest tolerance to environmental conditions were used. The general concept of genetics has remained the same, but the selection process has become more sophisticated.

The two methods of genetic manipulation used today are recombinant DNA and cell fusion. Recombinant DNA is the process of taking a gene or protein from one source and adding it to the DNA (genetic makeup) of another source to produce a new microorganism or modify an existing one. **Cell fusion** refers to the combining of two cells from different species in order to combine their genetic material and create a new organism.

Hybrids are new strains of plants created through crossbreeding. They are bred to produce particular strengths such as resistance to disease and drought.

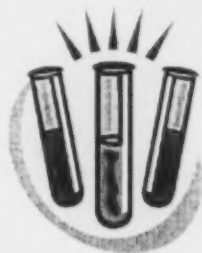
Polyculture is a concept that many experts see for the future of the agribusiness industry. **Polyculture** refers to growing a variegated mixture of crops. An example of polyculture would include combining fruits and vegetables. A whole new variety of foods can be provided through this process.

A high-producing milk cow—one that produces 23,000 pounds of milk each year compared to 13,000 pounds from an ordinary milk cow—can be given an ovulating hormone to cause it to produce extra ova (eggs). Once

fertilized, eggs are taken from the female and transplanted into ordinary milk cows. Calves are born that will be able to produce approximately 23,000 pounds of milk per year, thus increasing the amount of milk available for processing.

Breeders also have learned how to examine a fertilized egg and determine its sex. For dairy farms, this process can be very important. Dairy farms need females. Males are typically an added expense. On the other hand, beef ranchers have a greater need for males. The eggs can be sorted, with dairy breeders using the female eggs of dairy cows, beef ranchers using the male eggs of beef cows, and those not needed discarded. These fertilized eggs can be frozen under certain situations, sold, and transported to other countries where they can be implanted into native cows. The eggs can be transported more inexpensively than the cow. Another advantage of this method is that the native cow and the embryo automatically have a resistance or immunity to local diseases.

The primary concern with genetic engineering is not knowing if a particular genetic change or combination that is presumed to be beneficial will turn out to have negative effects. The recombinant DNA technology is more accurate in predicting potential problems than traditional breeding in which two complete sets of genetic material are combined randomly.



Aquaculture

The consumption of fish in the United States has increased approximately 30 percent. The number of fish available from the oceans has decreased. The increased demand for fish has encouraged the development of a new industry called aquaculture. Aquaculture refers to fish and fish farms primarily, but also covers almost anything that can be raised in water. Some vegetables are grown in water hydroponically without the aid of soil. Hydroponically grown vegetables are considered aquaculture products as well.

Food in Space

The scientific advancements that led to the ability to send men and women into space presented a new challenge to the food industry. If human beings could live in space, then provisions for the consumption of food became necessary. When designing food that could be consumed in space, food scientists had to consider the extremely different conditions that existed for astronauts.

Factors that affected the development of food products for space travel included the following:

- zero gravity
- vacuum chamber of the space cabin
- complications induced by the complexity of the space suit
- storage
- shelf life
- packaging
- palatability
- convenience
- aesthetic value
- nutritional value
- disposal of food waste

Some of the first foods sent to space were freeze-dried. Other foods were compressed foods and fruit bars. The advantages of freeze-dried foods for space travel include the following:

- Flavor and nutrient value are retained.
- Refrigeration and heating are not needed.

- Foods are lightweight (due to the water being removed).
- Packaging is easy.
- Shelf life is unlimited.

Freeze-dried foods have a spongy texture that could affect desirability after a period of time. The freeze-drying process is also very expensive, and the variety of freeze-dried foods is limited. The texture of some fruits and vegetables is significantly affected by the freeze-drying process.

The United States space exploration program has led to the development of a new class of food called intermediate moisture foods (IMF). **Intermediate moisture foods** are produced by adding humectants like glycerol, salts, sugars, and other additives that restrict the water activity and thus retard spoilage. Humectants are chemical compounds that help foods retain moisture but restrict the water activity in the food. Water activity is a measurement of free water in a food system. Microorganisms must have moisture to survive. If water is busy using salt, sugar, or other humectants, then bacteria cannot grow.

The IMFs were developed using the principles from an old preservation technique used by the Native Americans. They mixed berries, cereals, meats, and other ingredients to make a product they called pemmican. This mixture was partially dried to reduce spoilage, but the final product still retained enough moisture to make it chewable. IMFs produced today include breakfast bars, pet foods, and foods used for space travel.



◆ **Essential Questions:** ◆
Advances in Food Technology

1. How have advancements in food technology affected the family unit?
2. How is packaging selected for food products?
3. How have advancements in food technology impacted the space program?

TECHNOLOGY AND THE AVAILABILITY OF FOODS

Technology allows individuals to have more nutritious and greater varieties of food products. Technology facilitates international communication regarding growing, harvesting, and processing techniques as well as improvements in international trade. Agricultural knowledge and expertise are combined to provide an improved world food supply.

Due to food technology and the availability of foods, food preservation has become a focus of the food industry. Food scientists are aware of the importance of not only preserving the food through improved methods of processing but also finding the best possible methods that produce a minimum loss in nutritional value.

Marketing is affected greatly by advances in technology, especially in the United States. It is important to remember that with all of the advances in food technology and food processing, individuals still judge the quality of food based on appearance, smell, and taste. Regardless of the nutritional value of a food product, it must have a pleasant appearance, smell, and taste before it will be accepted by consumers.

Other factors important to consumers include the following:

- availability
- convenience
- cost
- quality
- safety

Food technology takes all of these factors into consideration. Getting food and food products from their original form to the consumer is a complex and often difficult process.

American Food Production and Distribution

The total output of agricultural products worldwide has increased consistently since the 1960s. In fact, world food production has risen slightly faster than the world's population. Despite the increase in world food production, there are still millions of people that are starving and millions that are undernourished.

Food production per capita is almost five times greater in developed countries than it is in developing countries. Developing countries have more difficulty growing crops because they are more vulnerable to crop disease and insect problems. Other difficulties include bad weather conditions, high energy costs, and unreliable distribution systems. These factors also influence the food production per capita. Developed countries have a higher level of agricultural productivity and higher income levels. Therefore, people in developed countries are able to find food products such as meat, eggs, and milk in plentiful supply.

Developing countries and those countries in the early stages of economic development include the following:

- Latin America (except Cuba)
- Greenland
- Africa (except Republic of South Africa)
- South Asia
- Southeast Asia (except Vietnam)

There are about 100 developing countries in the world. Approximately seventy of these countries are new countries. New countries are countries formed since World War II. Some estimates show that these developing countries account for approximately three-fourths of the world's population.

Developed countries are industrialized nations with strong economies and economic development. Developed countries include the following:

- Australia
- Canada
- Israel
- Japan
- New Zealand
- Republic of South Africa
- United States
- Western Europe

The American food production and distribution system, like the food production and distribution systems in most countries, begins when the soil is prepared for planting and ends when the final product is consumed. The stages between planting and consumption are very competitive in the United States, and food production and distribution is a major industry. Stages of the American food production and distribution system include the following:

- food, nutrition, and agricultural research
- plant and animal research
- agricultural production
- processing plants
- food product packaging and labeling
- transportation and storage
- marketing
- distribution
- retail food markets

A seed planted for agricultural production today is often one that has undergone substantial research. The seed has probably been genetically engineered to produce a high yield, to have maximum nutritional qualities, and to have an above average immunity to drought and other potential natural disasters.

Many have an immunity to certain herbicides. The soil must be properly irrigated and fertilized to produce maximum crops.

Once the crop is harvested, it must be processed and preserved. Processing and preservation can incorporate the traditional canning, freezing, dehydration, or individually quick frozen (IQF) processes.

The product may be processed through one of the following methods:

- aseptic processing
- extrusion
- fermentation
- microwave processing
- retort pouches
- vacuum packaging

The distribution process begins when the finished product is transported to major warehouse outlets. The products are then delivered to the local food or foodservice retailer (grocer, restaurant, or institutional food establishment). The retailer sells the product to the consumer.

Another method of distribution is called the **direct store delivery (DSD)**. The DSD process involves the product being purchased by a distributor from the major manufacturer. The distributor has its own fleet of trucks and representatives from the distributor call on the retail outlet. Once an order is placed, the distributor delivers the food product to the retailer.

Grocery store shelf space is very costly in the United States. With the millions of products available for placement on grocery store shelves, the competition for shelf space is very strong. Thousands of dollars are spent to get a particular product on a grocer's shelf in the preferred location.

The American food distribution system differs from that of other countries for several reasons. The United States has better equip-

ment for planting, harvesting, processing, and distributing food and food products. More updated technology for agricultural products and the increased use of automation makes it substantially different from many other systems.

Technology introduced the use of the **Universal Product Code (UPC)**. The UPC is a bar code with numbers that is placed on the packages of food products and thousands of other items. The bar code is easily read by a computer scanner and is used for checking foods into and out of manufacturer's shipping rooms, distributor warehouses, and retail food stores. Cashiers at grocery stores use special cash registers and equipment to scan the UPC. Once scanned, an item is listed on the receipt by name, weight or type, and price. This process itemizes and totals the customer's grocery purchases. It is faster, less expensive, and allows for fewer mistakes than manual methods.

Breakdowns in the food production and distribution system in the United States are generally localized. For example, if a crop is lost in Texas, it primarily affects Texas rather than the country as a whole. If a crop of citrus fruits were lost in Texas, replacement fruit could be purchased from Florida then transported and distributed in Texas. The final cost may be higher, but the product would still be available. A problem with food distribution such as this affects major metropolitan areas first because of the larger population and larger numbers of purchases and demands for the product.

Artificial and Synthetic Foods

Synthetic foods have made an impact on the preservation and processing of foods. Synthetic foods are made by a process that manipulates food materials. Carbohydrates, fats, proteins, and vitamins used in artificial or synthetic foods are often made from microorganisms. Chemical conversions are usually involved. These synthetic foods can be made by spinning plant proteins and other ingredi-

ents into fiber-like structures. Synthetic bacon, beef, and poultry can be made in this manner. Synthetic crab, lobster, and beef analogues have increased in popularity in recent years.

◆ **Essential Questions:** ◆
Technology and the Availability of Foods

1. What factors do consumers consider when making food selections?
2. What are the stages of the food production and distribution system?
3. How does food availability compare in developing countries to the United States?

MARKETING AND MARKET RESEARCH

Marketing refers to the process involved in moving food and food products from the producer to the consumer. It combines product, price, place, and promotion. Marketing involves determining who the potential customers are and their wants and needs. It involves stocking products to satisfy those wants and needs and then getting the merchandise into the customer's possession. It also involves executing a sales idea, pricing the merchandise, and promoting it. The primary objective of marketing is to help businesses make a profit while providing customers with goods or services that satisfy their wants and needs.

Marketing is an ongoing project of any food-related business. Consumer habits, tastes, wants, and needs vary seasonally and sometimes yearly. The marketing process involves analysis, planning, execution, reviewing, and more planning. The decision to use any or all marketing techniques mentioned requires

experience and judgement. In order to be successful, a business marketing program must be constantly evaluated.

Wholesalers play an important role in the marketing of foods and food products.

Wholesalers buy from growers or processors and sell to retail food markets. Thus they must remain informed about product availability and price fluctuations from growers or producers and they must learn about consumer wants and needs from the retail food markets.

Food brokers sell food for a manufacturer but never take actual possession of the food as the wholesaler does. Food brokers are independent and receive a certain dollar percentage of the products sold.

The wholesaler or food broker gives the retail food markets information about the market and about ways to satisfy customer wants and needs. The wholesaler or food broker can usually predict local consumer spending habits by events that take place nationally or geographically. Current information about consumer demand, availability, prices, and new trends in the industry is provided to the retailer from the wholesaler or food broker.

Wholesalers and food brokers learn from retail food markets which items consumers have been purchasing and which items have not sold. Wholesalers and food brokers advise retail food market owners and managers about shifts in product demands, product supply, and prices so that retail food markets can adjust their purchasing accordingly. This type of information is important for retail food markets because it allows them to make smart, profitable purchases. A wholesaler or food broker gives food retailers this information in various ways. They may inform sales personnel, distribute newsletters or other publications, or communicate directly with food retailers.

In addition to information about market conditions and product supply, wholesalers and food brokers often give retail food markets suggestions for improving the sale of particular products or ideas for displaying products. The wholesaler and food brokers are usually informed about new trends and about certain selling or merchandising techniques that have been successful for other retail food markets. Figure 16.1 identifies ways to market a product.

Ways to Market a Product

- Through the choice of a name for the product
- By developing a product that is very convenient and has high utility
- By packaging that is appealing in form and color
- Through labeling that is informative and readable
- By pricing the product so that it competes successfully with other brands
- By conducting marketing surveys and planning a strategy for introducing the product to the market
- Through an effective advertising campaign

⇒ **Figure 16.1**

Advertising

Advertising is the action of favorably presenting goods for sale to the public using paid announcements publicized or broadcast by the media. It is a communication process, a marketing process, and an economic or

social process that is directed to groups of people instead of individuals. Most advertising reaches the consumer through newspapers, television, radio, billboards, Internet and the mail. More subtle methods of advertising reach the consumer through the marketing of store and window displays, services offered by the store, and employees. Advertising's primary purpose is to inform, persuade, and remind customers of particular products and services. Advertising is used to encourage consumers to purchase merchandise. The six basic categories of advertising are national advertising, local advertising, direct marketing advertising, trade advertising, industrial advertising, and professional advertising.

National advertising is also known as brand-name advertising. The emphasis is placed on a specific product instead of a place where the product can be purchased. Examples include a specific brand of chicken, frozen dinner, or mayonnaise. The price is typically not mentioned in this type of advertising. National advertising is commonly found in magazines, on radio and television, and occasionally in newspapers. Figure 16.2 lists common advertising techniques that influence food selection.

In local advertising, which is produced and used locally, the price is usually mentioned because its purpose is to get customers into particular stores. Local advertising appears in newspapers, on radio and television, and occasionally in regional editions of national magazines. Information may include weekly specials, new products, or coupons for particular items.

Direct marketing advertising also is referred to as direct mail advertising. Examples include coupon packages or free samples of new products that are delivered through the mail to the consumer.

Advertising Techniques that Influence Food Selections

A promise of better health, such as more energy, more physically fit

A promise of better looks, such as sex appeal and improved appearance

A promise of better performance, become better athlete, improve job performance

Use of endorsements from athletes, movie stars, experts

A promise of increased enjoyment such as fun, good taste, makes you happy

A promotion of your social standing, such as increased status, popularity

⇒ Figure 16.2

Trade advertising is directed toward retail food markets, wholesalers, and brokers. This also is referred to as business to business advertising. Grocers, wholesalers, and brokers are the producer's customers. This advertising stresses the benefits of the product and the potential profits that can be made as a result of stocking and selling a particular item.

Industrial advertising is directed toward processors. Processors purchase raw materials and machinery for use in the production process. This advertising is placed in trade magazines and is sent by direct mail advertising methods.

Professional advertising is directed to physicians, dietitians, and other professionals who help direct or recommend various products to others. This type of advertising stresses the benefits of the product rather than the profits to be made. The ads appear in professional and trade magazines, through

actual samples of the product, and through direct mail.

New Trends in Marketing Food

As a result of the changing population, the ways food is marketed to the consumer have changed. Cities now have **hypermarkets** where consumers can buy a variety of things including shaving cream, houseplants, gourmet items, seafood, or exotic produce. These hypermarkets have mini-hothouses (small greenhouses) where customers can watch fresh tomatoes and other produce growing on the vine.

Other supermarkets offer **warehouse shopping** where shoppers can buy quantity items at a lower cost. Some food stores even offer ***gourmet boutiques***. The gourmet boutique prepares gourmet meals for takeout. Some even offer dinner with a movie rental.

Competition among retailers has added a new interest in special services at the supermarket. Many supermarkets have in-house nutritionists and in-house chefs to aid consumers in making food buying decisions.

Along with these services, consumers can find takeout food; mail service; tax advice; and fresh, ready-to-cook foods such as pork roast with stuffing, shish kebabs, or prepared salads. The supermarket shopper of today can buy everything from the food and flowers to the stemmed glassware for a candlelight dinner at home.

As sales of fresh and frozen foods increased, sales of canned foods dropped. In response, the manufacturers of canned vegetables have offered new products to regain some of the lost sales. First came the vegetables canned without added salt. Although sales of low-salt canned foods have been slow, the sales of canned foods in general are increasing. The most recent advance in canned products is the **Veri-Green process**. The **Veri-Green process** stabilizes the chlorophyll in

vegetables and gives the product a better color, flavor, and texture. This is expected to be well received by consumers.

With the food industry offering the consumer choices from approximately 50,000 items in the supermarket, the demand for new and creative marketing techniques will continue to increase.

Marketing Research Tools

Market research is an integral part of the American marketing system. It enables producers, distributors, and retailers to gear their marketing plans to meet the wants and needs of their target customers. Market research uses various survey techniques or tools to identify the following:

- consumer incomes
- consumer habits
- occupations of household members
- consumer buying habits
- household size
- ages of heads of households
- education levels

Research tools include market surveys, company records regarding past purchasing, telephone surveys, and mail surveys. Large producers can determine what products sell in various parts of the country as well as what percentage of consumers purchase particular brands of products. Table 16.1 illustrates a sample of some of the categories of questions asked and results received in a marketing survey.

Cost of Marketing

The cost of advertising and marketing products can incorporate as much as 40 percent of the final product cost. This cost includes research, product testing, packaging, labeling, distribution, and other costs related to getting the product from the producer to the consumer.



The money spent on advertising and marketing also is used to educate the public about new research and progress in the field of food science and nutrition. Consider the many cereal advertisements that have made the public aware of the need for fiber to decrease the chance of colon cancer or the use of certain cooking oils to lower cholesterol intake. Negative advertising normally includes what a product does not have such as no preservatives, no cholesterol, and low sugar. The advertisements or packaging may be enough to entice individuals into purchasing a particular product that they would not normally purchase.

◆ Essential Questions: ◆ Marketing and Marketing Research

1. How does advertising and marketing affect the price of food products?
2. How has technology affected marketing?
3. What are the tools used in a marketing survey?

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Sample Marketing Survey Results					
	Distribution of Households Surveyed	Total Households That Use the Product	Households That Use Brand A	Households That Use Brand B	Households That Use Brand C
<u>Income of Household</u>					
Less than \$12,000	20 %	104	89	64	62
\$12,000-\$19,999	18	96	94	132	84
\$20,000-\$24,999	14	103	101	93	75
\$25,000-\$29,999	10	115	113	76	51
\$30,000-\$39,999	16	103	114	137	94
\$40,000 or more	22	95	99	96	187
<u>Occupation of Male Head</u>					
Professional	29 %	96	91	115	180
White Collar	9	84	98	160	72
Blue Collar	33	113	110	72	55
Not in Work Force	29	95	101	95	95
<u>Occupation of Female Head</u>					
Professional	22 %	86	86	91	110
White Collar	40	79	76	52	71
Blue Collar	18	99	98	155	165
Not in Work Force	20	115	114	102	91
<u>Household Size</u>					
1-2 Members	45 %	76	86	92	97
3-4 Members	41	121	113	105	84
5 or more Members	14	164	140	120	160
<u>Education of Female Head</u>					
Not High School Graduate	10.5 %	118	90	105	68
High School Graduate	40	110	118	94	80
Some College	26	91	94	75	170
College Graduate	29.5	93	86	145	90
<u>Education of Male Head</u>					
Not High School Graduate	9 %	116	88	106	66
High School Graduate	39.8	107	115	96	82
Some College	21.2	90	93	72	150
College Graduate	30	93	87	140	93

Table 16.1



Chapter Highlights

- ☆ The food service industry is greatly influenced by economic trends, technological developments, and lifestyle changes.
- ☆ The goal of food packaging is not only to keep the food it surrounds fresh, but also to serve as a marketing device intended to capture the attention of consumers and encourage them to buy the product.
- ☆ Food technology involves all aspects of getting food and food products from their raw state to the consumer.
- ☆ Marketing involves determining who the potential customers are and their wants and needs.
- ☆ Advertising is a communication process, a marketing process, and an economic or social process that is directed to target groups of people instead of individuals.
- ☆ Food technology refers to the total sequence of food products from raw materials to production, processing, preservation, and distribution.
- ☆ Technology introduced the use of the Universal Product Code (UPC), which is the bar code with numbers that is placed on the packages of food products.
- ☆ The Veri-Green process stabilizes the chlorophyll in vegetables and gives the product a better color, flavor, and texture.
- ☆ Market research is an integral part of the American marketing system. Research tools include market surveys, company records regarding past purchasing, telephone surveys, and mail surveys.
- ☆ The cost of advertising and marketing products can incorporate as much as 40 percent of the final product cost.

Chapter 17

Nutrition, Food Science, and the Consumer



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 6A Evaluate resources that provide reliable nutrition information.
- 6B Propose ways to disseminate reliable nutrition information.
- 7C Explain the roles of additives in food processing.



Chapter Vocabulary

adulterated foods
consumer
FDA
food additives
GRAS list
incidental food
additives

intentional food additives
junk science
misbranded foods
organic foods
prior-sanctioned substances
unit pricing

RELIABLE NUTRITION INFORMATION

A variety of resources are available to provide the consumer with reliable nutrition information. Amidst the enormous amount of diet and nutrition information presented by the media, it is sometimes difficult for consumers to distinguish fact from fallacy.

In teaching nutrition education to children, adolescents, and adults, it is important to depend on reliable sources for nutrition information.

Nutrition Experts, Agencies, and Organizations

We are living in a time of "information explosion" where there is more information available than consumers can absorb and critically evaluate. This is especially true in

areas related to nutrition, health, and food science. The media abounds with claims for weight loss remedies, miracle cures for ailments, "beauty" concerns, recommendations for mega-dosages of vitamins, and products to fix almost anything.

It is important to become a wise and cautious consumer of nutrition and health information. Each individual is a **consumer** who buys and uses products and services. The best sources of reliable nutrition information and sound advice on weight loss and diet-related disorders are agencies, organizations, and institutions that staff qualified nutrition experts. These professionals have special academic training and credentials in the science of nutrition. Many are registered dietitians (RD) and licensed dietitians (LD); others have advanced degrees in nutrition and health sciences. Many registered dietitians are in private practice with physicians or work in the health care field. The following are some sources of reliable nutrition information:

- American Cancer Society
- American Diabetes Association
- American Dietetic Association
- American Heart Association
- Food and Drug Administration
- National Council Against Health Fraud, Inc.
- Texas Agricultural Extension Service
- Texas Department of Health and Human Services
- United States Department of Agriculture
- city health departments
- educational programs, including classroom instruction and textbooks
- professionals, such as registered dietitians, university nutrition professors, and family and consumer sciences educators
- professional journals

Publications in professional journals as well as other periodicals provide current information on nutrition. Some of the professional journals include the following:

- *Critical Reviews in Food Science*
- *Food Science and Nutrition*
- *Journal of the American Dietetic Association*
- *Journal of Food Science*
- *Journal of Nutrition*
- *Journal of Nutrition Education*
- *Journal of Clinical Nutrition*
- *Nutrition Today*
- *School Food Service*

Newsletters

A variety of newsletters dispense reliable information related to food science and nutrition. Organizations, medical facilities, consumer agencies, and large corporations that have food science and nutrition related products publish them. Some of the food and nutrition newsletters that are available include the following:

- *Consumer Reports Health Letter*
- *Dairy Council Digest*
- *Food Insights*
- *Food and Nutrition News*
- *Nutrition News and Views*
- *Tufts University Diet and Nutrition Newsletter*



The Media

The media are valuable sources of information. However, not all information conveyed through the media or on the Internet, especially that related to advertisements for various products, is completely accurate or reliable. This makes it difficult at times to distinguish between the reliable and the unreliable. Newspapers, magazines, and television health segments are usually accurate. Media distribution of information related to certain diseases can be reliable and educational. The media is mainly responsible for the public's awareness of certain health issues related to heart disease, high cholesterol, diabetes, and cancer.

Computer software programs are available that will evaluate and make suggestions on nutrition and diet. Computers can be used to select food with specific amounts of nutrients and to plan balanced meals. Many software programs can also analyze the nutrient value of a person's meals, snacks, and recipes. Physical activity and exercise programs also may be analyzed.

Many businesses and agencies have incorporated toll-free 800 numbers and Internet Web sites into their marketing plans. The 800 numbers and Web sites allow consumers to call or E-mail with questions related to a particular product. The USDA has a meat and poultry hot line available to answer questions about defrosting and cooking instructions as well as nutritional information.

When dealing with media distribution of information related to food science and nutrition, an individual should be cautious. Many people believe all information seen or transferred is accurate. Unfortunately, this is not always true. An individual should consider the sources, read the fine print, and confirm the information by checking two or more other reliable sources available.

The New Food Label

As an informed consumer, using food labels can guide in choosing food selections that are both healthy and nutritious. Labels are the main source of information for food products. See Figure 17.1 for food label claims and their definitions.

THE FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration (FDA) is an agency of the United States Department of Health and Human Services. The main function of the FDA is to ensure that the United States food supply is pure, safe, and wholesome and to enforce the Food, Drug, and Cosmetic Act of 1938 and its amendments.



Enforcing FDA Regulations

The Food and Drug Administration (FDA) employs inspectors and investigators to enforce the laws that pertain to the food, drug, and cosmetic industry. The FDA inspectors visit drug and food plants to test samples of foods and other products to make sure that they adhere to the law. FDA district offices have laboratories where chemists and other scientists test and evaluate samples of foods and other products to be sure they meet the standards set by the law. In order to maintain control over the labeling, purity, quality, and wholesomeness of foods, the FDA performs

Food Label Claims

<u>Label Claim*</u>	<u>Definition</u>
Calorie Free	Less than 5 calories
Low Calorie	40 calories or less
Light or Lite	1/3 fewer calories or 50% less fat; if more than half the calories are from fat, fat content must be reduced by 50% or more
Light in Sodium	50% less sodium
Fat Free	Less than 1/2 gram fat
Low Fat	3 grams or less fat**
Cholesterol Free	Less than 2 milligrams cholesterol and 2 grams or less saturated fat**
Low Cholesterol	20 milligrams or less cholesterol and 2 grams or less saturated fat**
Sodium Free	Less than 5 milligrams sodium**
Very Low Sodium	35 milligrams or less sodium**
Low Sodium	140 milligrams or less sodium**
High Fiber	5 grams or more fiber

* Per Reference Amount (standard serving size) (Some claims have higher nutrient levels for main dish products and meal products, such as frozen entrees and dinners.)

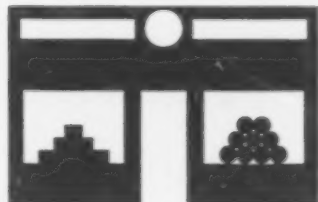
** Also per 50g for products with small serving size (Reference Amount is 30g or less or 2 tbsp or less.)

⇒ Figure 17.1

several functions. These functions include the following:

- establishes and enforces the regulations that apply to new food additives and the amounts that can be used
- inspects and checks for the safety of food colors
- inspects imported food products to be sure they adhere to federal law
- issues the guidelines that ensure consumers that the composition and real value of the food products they buy are in line with the congressional mandate to "promote honesty and fair dealing in the interest of the consumers"
- sets the standards for the amounts of pesticide chemical residues that may be found on food crops
- checks shipments of food crops to be sure they are within the stated guidelines
- works with state and local inspectors to remove contaminated products from the marketplace

If FDA inspectors or investigators find adulterated or misbranded food items, those products can be removed. **Adulterated foods** are food products that are inferior in quality due to some mishap that occurred during processing or packaging. **Misbranded foods** are those foods that have been labeled incorrectly. For example, if tomato sauce was labeled as tomatoes, it would be considered misbranded. The FDA has authority under federal court to seize the items and charge the business or persons responsible with violating federal law. They would be subject to criminal prosecution.



Protecting the nation's food supply is considered a major responsibility of the U.S. government. This elaborate system of regulations, inspections, and investigations enables American consumers to purchase food, drugs, and cosmetics with confidence that the products are of pure and wholesome quality.

Nutrition and Health Fraud

There is a massive growth of nutrition and health fraud in the United States today. Persons behind this type of fraud seek financial gain at the expense of consumers searching for solutions to health-related problems. This practice, often referred to as "**junk science**," has grown throughout the United States due to increased consumer interest in personal health care and those seeking a "quick fix" to diet and health problems. Anytime you hear claims that appear to be "unbelievable," recall information previously learned about sources of reliable nutrition information and nutrition fraud. Take extreme caution when responding to advertisements and claims such as:

- Recommendations that promise a quick fix
- Dire warnings of danger from a single product or regimen
- Claims that sound too good to be true
- Simplistic conclusions drawn from a complex study
- Recommendation based on a single study
- Dramatic statements that are refuted by reputable scientific organizations
- Lists of "good" and "bad" foods
- Recommendations made to help sell a product
- Recommendations based on studies published without peer review
- Recommendations from studies that ignore differences among individuals

As a conscientious and informed consumer, it is important to learn to distinguish reliable nutrition and health information from nutrition fraud. Consumers can protect family and friends from falling victims to this

type of fraud by sharing knowledge of reliable sources of nutrition information.

Essential Questions:
Reliable Nutrition Information

1. Why is it important to be familiar with reliable sources of information for nutrition and food science?
2. What are disadvantages of nutrition information disseminated through the media?
3. Who and what can an individual trust with regards to nutrition and health information?
4. What are some functions of the FDA?

Your Rights as a Consumer

- the right to be informed
- the right to choose
- the right to be heard
- the right to safety
- the right to consumer education
- the right to consumer redress
- the right to a healthy environment

Figure 17.2

RIGHTS AND RESPONSIBILITIES OF CONSUMERS

The power a consumer has to purchase the goods and services wanted depends on the knowledge of rights and responsibilities as a consumer. Federal and state laws protect consumer rights. Problems and issues can be solved in the marketplace by exercising consumer rights and responsibilities. Consumer rights are listed in Figure 17.2.

Making a consumer complaint in an appropriate manner will aid in a satisfactory response. Using personal relationship skills while following a logical order of steps can resolve the problem in a timely manner. See Figure 17.3.

Being aware of the proper channels to go through with a complaint and knowledge of rights and responsibilities of consumers helps address the potential problems in the marketplace.

Steps to Making a Consumer Complaint

1. Try to return or exchange the item. Having the receipt is usually necessary for refund of money.
2. If you are not satisfied with store response, contact the manufacturer of item by letter or phone. Explain the problem, and have any identifying information or product numbers available for reference for the consumer complaint representative.
3. If the issue is still unresolved, you may have to contact a government office (FDA for problems with food products). The consumer affairs representative can serve as an advocate for you to solve the issue.

Figure 17.3

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Wise Food Shopping

Price is one of the major factors that affect consumer choices and decisions when shopping for food products. Consumers can compare prices, quantity, and quality of a certain food if they use **unit pricing**. Unit price is a food's cost per standard unit of weight or volume. An individual can compare cost per ounce, per quart, per dozen or other units of measure. Usually tags or labels attached to the grocery store shelves display the unit price of items on that particular shelf. Unit prices help the consumer choose which form, size, or brand of food item is the best buy.

Wise consumers compare price, product quality, and use a variety of techniques to ensure they are getting the most from their food dollars.

Some consumers are concerned with the number of chemicals used to grow and process foods and look for organic food products.

Organic foods are processed without the use of man-made pesticides, fertilizers, or growth hormones. Organic farming techniques and methods tend to use manure or compost to fertilize the soil and natural pesticides to control insects. Some health and nutrition experts choose only organic produce, but research has not found organic foods to be more nutritious. The average cost of organic foods can be considerably higher than nonorganic.

Consumers and buyers can save money and time while still benefiting nutritiously. See Figure 17.4, Ten Steps to Supermarket Savvy.



◆ Essential Questions: ◆ Rights and Responsibilities of Consumers

1. What rights and responsibilities do consumers have?
2. What factors influence and affect consumers when selecting food products?
3. How can understanding food labels help consumers make nutritious choices?

FOOD ADDITIVES

Food additives are newsworthy items as consumers become more informed about food-related issues. For centuries, people have been using food additives to improve taste or appearance, to keep food from spoiling, or to give variety to their meals. Spanish explorers' quest for spices and other flavorings for foods led to the discovery of the vanilla bean by Hernando Cortez. In the 1800s, Texas settlers discovered they could use the chili powder made from ground peppers to add flavor to meats and other foods.

Basically, the reasons food additives are used have not changed, but advanced scientific knowledge and technology have changed how they are used. The rapidly expanding population of the world increases the importance of food additives. Since only two percent of the population grows the food for the other 98 percent, much of the food would never reach consumers if food additives were not available. Many types of food additives are available that perform many different functions. They allow the food supply to be safe, palatable, and flavorful and give food an acceptable shelf life. Shelf life refers to the length of time a food can be stored without spoiling or deteriorating. In order to feel confident about the safety of the United

Ten Steps to Supermarket Savvy

1. Plan, plan, plan!
 - a. Plan menus using advertised specials and coupons.
 - b. Make a list of foods you need and follow your list to avoid impulse purchases.
 - Basic supplies to restock your pantry
 - Ingredients needed for recipes in your menu plan
 - Items listed according to the store layout
 - c. Be prepared to be flexible if you find unadvertised specials.
2. Buy the right amount of food to avoid spoilage or leftovers that won't be used up.
3. Shop at a convenient time, but avoid shopping when you are hungry.
4. Shop as seldom as possible. The more you shop, the more you buy.
5. Evaluate foods for nutritional quality.
 - Read nutrition information on labels.
 - Beware of hidden fat in canned, packaged, and bagged convenience foods.
6. Use unit pricing to compare the cost of similar foods.
7. Be aware of your criteria for food purchases.
 - quality
 - method and time of preparation
 - environmental impact of purchase and preparation
 - cost
 - nutritional quality
8. Plan purchases of perishable foods carefully to avoid waste and shop for these foods last to avoid spoilage or loss of quality.
9. Be aware of foods that are in season, and therefore offered at lower prices and better quality.
10. Be aware of marketing techniques used by food stores to encourage impulse purchases.
 - End-of-aisle displays
 - Checkout displays
 - Impulse foods at eye level
 - Food tasting and samples
 - Heavily advertised products

Source: *Nutrition and Wellness Resource Guide: A Resource for Teaching the Nutrition and Wellness Core Course Area of Ohio's Work and Family Life Program*. (Columbus, Ohio: The Ohio State University, Vocational Instructional Materials Laboratory). Copyright 1994. Used with permission.

⇒ **Figure 17.4**

States food supply, it is important for consumers to have factual information and a clear understanding about food additives.

Food additives are substances not normally consumed alone but are added to food intentionally or incidentally by being absorbed into the food. Food additives perform many beneficial functions that make food safe and flavorful with keeping qualities that people expect. These functions are listed in Figure 17.5.

Functions of Food Additives	
■ Appearance and Taste	The coloring agents, flavorings, flavor enhancers, and sweeteners improve taste and appearance.
■ Freshness	Preservatives prevent rancidity (spoilage) of fats, help retain natural color in foods, and retard spoilage.
■ Nutritional Content	Food additives improve the nutritional value of some foods through fortification and enrichment of important vitamins and minerals.
■ Processing and Manufacturing	Food additives, such as stabilizers, thickeners, texturizers, and emulsifiers, enable consumers to have convenient food products that blend, mix, and bake successfully with the body and texture that is desired.

⇒ **Figure 17.5**

The major reason for using food additives is to prevent food spoilage. Food spoilage caused by bacteria, fungi, molds or yeast can lead to serious foodborne illnesses. Foodborne illnesses are infections that occur when people eat food that has been contaminated by harmful microorganisms. Food spoilage also changes the flavor and texture of foods. Food additives keep salad dressings from separating, bread from molding, and cured meats safe for consumption. Without additives, many of the foods people enjoy would not be available in the desired form.

The FDA has highlighted five major functions of food additives:

- to maintain product consistency
- to improve or maintain nutritional value
- to maintain palatability and wholesomeness and reduce spoilage by mold and bacteria
- to leaven and control acidity or alkalinity
- to enhance flavor or to give color

Intentional Food Additives

Food additives are classified into two categories: intentional food additives and incidental food additives. **Intentional food additives** are additives that are purposely added to foods to improve appearance, flavor, texture, or nutritive value or to prevent spoilage. Some examples of intentional food additives are food colorings added to improve appearance, vitamin C added to fruit drinks to improve nutritive value, and preservatives added to maintain freshness. Of all the intentional food additives used, 98 percent are citric acid, corn syrup, salt, and sugar. Many other intentional additives are used in processing food products. Table 17.1 identifies common intentional food additives.



Incidental Food Additives

Incidental food additives are substances that become part of the food indirectly. Sometimes incidental additives can get into food by coming in contact with the food while it is growing or being manufactured. For example, small pieces of packaging materials that may accidentally get into the food or trace quantities of substances, such as pesticides used in the growing of the food, are incidental additives. The FDA regulates incidental additives as they do intentional additives. Food processing companies must continuously check for materials from processing or packaging that may have drifted into the food.

Intentional Food Additives	
Additive	Description
Anticaking Agents	Prevent lumping or caking of a finely powdered substance
Antioxidants	Delay or prevent a food product from turning rancid or browning
Colors	Give an appetizing or characteristic color to foods and increase product acceptance
Emulsifiers	Help to evenly distribute tiny particles of one liquid into another and improve the consistency, stability, and texture of food products
Flavor Enhancers	Supplement or heighten the original taste and/or aroma of food without changing or adding their own flavor
Flavors	Heighten natural flavor and/or restore flavors lost in processing
Humectants	Cause a food product to retain moisture
Leavening Agents	Affect cooking results, texture, and volume of food products
Maturing and Bleaching Agents; Dough Conditioners	Accelerate the aging process of the food product as well as improve its baking qualities
Nutrients	Enrich (replace vitamins and minerals lost in processing) or fortify (add nutrients that may be lacking in a person's diet) a food product to maintain or improve nutritional value
pH Control Agents	Change or maintain the acidity or alkalinity in food and drink products
Preservatives	Prevent food from spoilage by bacteria, molds, fungi, and yeast; extend the shelf life and protect the natural color or flavor of a product; prevent chemical reactions that cause food to deteriorate
Stabilizers, Thickeners, Texturizers	Impart body, improve consistency or texture, stabilize emulsions, and affect how the food feels in the mouth
Sweeteners	Make the smell or taste of food more agreeable or pleasurable

Table 17.1

Common Additives

Approximately 3,000 different food additives are common in the food supply. It is important to refrain from making generalizations about all food additives because no two are exactly alike. Each additive should be evaluated individually regarding its safety and purpose. Table 17.2 lists some common food additives and their purposes. These additives might be seen on labels of commonly eaten foods.

Food Additive Regulation

The FDA is the government agency responsible for regulating food additives in the nation's food supply. The FDA is most concerned with the safety of the additives rather than with their effectiveness. The manufacturers are required to petition the FDA for permission to use a new food additive. This is a lengthy procedure that requires the manufacturers to show that the additive is safe for human consumption. It may take as long as several years for the additive to gain approval from the FDA.

The manufacturer must perform a series of chemical tests and animal feeding studies to indicate to the FDA that the additive adheres to the following guidelines:

- The additive must be proven to serve a necessary or useful purpose.
- The additive effectively performs the function for which it is intended.
- The additive does not conceal decay or disease.
- The additive is generally recognized as safe for human consumption.
- The additive is identified on the food label.

The manufacturer must submit the results of all tests conducted on the substance to the FDA for examination. Next, the FDA conducts a public hearing in which experts testify to the advantages and disadvantages of the proposed food additive. Following the hearing, the FDA determines whether or not to approve the additive. Even if the additive is

approved, the manufacturer must follow strict regulations for use of the additive. The FDA outlines exactly in which foods the additive may be used and in what amounts. No food additives are approved indefinitely. All food additives are periodically reviewed by the FDA.

Many laws regulate the food industry. These laws and regulations serve to assure consumers that food safety is practiced. The authority to regulate food and food ingredients was given to the FDA by the Food, Drug, and Cosmetic Act of 1938. The rules and requirements for truth in labeling are also identified in this act. In 1958, the Food Additives Amendment was added to the act. This amendment requires manufacturers to receive FDA approval of an additive before it can be used in foods or food processing. The manufacturer also must show the FDA that the additive is safe in the ways it will be used in food.

Two groups of substances were excluded from food additive regulations. The first group is referred to as **prior-sanctioned substances** and refers to those substances that the FDA or United States Department of Agriculture (USDA) had determined were safe for use in food prior to the 1958 amendment. The second group of substances is identified on a list published by the FDA in 1958 known as the GRAS list. GRAS is an acronym for generally recognized as safe. The **GRAS list** contains the names of substances that have been determined long ago to be safe for use in foods or for which there is published scientific evidence of their safety. Substances, such as salt, spices, and sugar, are on the GRAS list. The FDA and USDA continues to monitor new scientific research as it applies to food additives that are prior-sanctioned substances and/or on the GRAS list.

Common Food Additives

Additive	Function
Acetic acid	pH control
Ascorbic acid (vitamin C)	nutrient, antioxidant, preservative
Beta carotene	nutrient, color
BHA (butylated hydroxyanisole)	antioxidant
BHT (butylated hydroxytoluene)	antioxidant
Calcium phosphate	leavening
Calcium propionate	preservative
Calcium sorbate	preservative
Carob bean gum	stabilizer, thickener, texturizer
Carrageenan	emulsifier, stabilizer, thickener, texturizer
Cellulose	stabilizer, thickener, texturizer
Citric acid	preservative, antioxidant, pH control
Corn syrup	sweetener
Dehydrated beets	color
Fructose	sweetener
Gelatin	stabilizer, thickener, texturizer
Glucose	sweetener
Glycerol monostearate	humectant
Guar gum	stabilizer, thickener, texturizer
Hydrogen peroxide	maturing and bleaching agent, dough conditioner
Hydrolyzed vegetable protein	flavor enhancer
Invert sugar	sweetener
Iodine	nutrient
Lactic acid	pH control, preservative
Lecithin	emulsifier
Locust bean gum	stabilizer, thickener, texturizer
Mannitol	sweetener, anticaking, stabilizer, thickener, texturizer
Modified food starch	stabilizer, thickener, texturizer
Monoglycerides	emulsifier
MSG (monosodium glutamate)	flavor enhancer
Paprika	flavor, color
Pectin	stabilizer, thickener, texturizer
Phosphoric acid	pH control
Polysorbates	pH control
Potassium sorbate	preservative
Propylene glycol	stabilizer, thickener, texturizer, humectant
Saccharin	sweetener
Sodium acetate	pH control
Sodium benzoate	preservative
Sodium bicarbonate	leavening agent
Sodium nitrate	preservative
Sodium nitrite	preservative
Sorbic acid	humectant, sweetener
Sorbitol	humectant, sweetener
Tartaric acid	pH control
Vanilla, vanillin	flavor
Yeast-malt sprout extract	flavor enhancer

⇐ **Table 17.2**

◆ **Essential Questions:** ◆
Food Additives

1. Why should consumers be aware of food additives?
2. What does the term shelf life refer to?
3. What is the difference between intentional and incidental food additives?

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Chapter Highlights

- ☆ A variety of reliable resources are available to provide nutritional information. Consumer information can be obtained from professional journals, community organizations, professionals, media distribution, and educational programs.
- ☆ The FDA and USDA warn consumers of fraudulent labeling and publish warnings to the public if hazardous food products are found.
- ☆ Food additives perform many beneficial functions that make the food safe and flavorful with acceptable keeping qualities.
- ☆ Knowledge of product labeling, unit pricing, and food additives aids the consumer in making good food decisions.
- ☆ Many laws regulate the food industry. These laws and regulations serve to assure consumers that food safety is practiced. The authority to regulate food and food ingredients was given to the FDA by the Food, Drug, and Cosmetic Act of 1938.
- ☆ The media is mainly responsible for the public's awareness of certain health issues related to heart disease, high cholesterol, diabetes, and cancer.
- ☆ Adulterated foods are food products that are inferior in quality due to some mishap that occurred during processing or packaging.
- ☆ Misbranded foods are those foods that have been labeled incorrectly.
- ☆ Intentional food additives are additives that are purposely added to foods to improve appearance, flavor, texture, or nutritive value.

Chapter 18

Research in Food Science and Technology



Chapter Focus

The following Essential Knowledge and Skills are discussed in this chapter:

- 3A Apply science skills in conducting laboratory activities.
- 10A Analyze various research methods used in food science, technology, and nutrition.
- 10B Describe ways to choose topics for research in food science, technology, and nutrition.
- 10C Evaluate research projects related to a current issue in food science, technology, and nutrition.



Chapter Vocabulary

chromosomes
cytogenetics
genes
hypothesis
interpretations

observations
research
scientific method

RESEARCH IN NUTRITION, FOOD SCIENCE, AND FOOD TECHNOLOGY

Nutrition has not always been recognized as a contributing factor to disease prevention. The American Institute of Nutrition was established in the 1930s. Prior to that time, researchers focused their work on the germ theory of disease. Drugs and vaccines, such as

the smallpox vaccine, were developed to fight many diseases. It had been known for years that individuals could only contract smallpox once. Once individuals have smallpox and recover, they become immune to it.

Not long after scientists discovered vaccinations they discovered that some diseases resulted from certain deficiencies in the diet, such as:

- goiter – a result of iodine deficiency
- pellagra – a result of niacin deficiency

- rickets – a result of vitamin D deficiency
- scurvy – a result of vitamin C deficiency

Researchers discovered that these diseases could be cured by adding sufficient amounts of the appropriate nutrient to the diet. People in the United States do not need to be as concerned about deficiency diseases as they were fifty years ago due to valuable information learned from research studies. To maintain health, individuals need to eat a well-balanced diet with appropriate servings from each of the food groups. Fortification, enrichment, and general nutrition education have improved the quality of food products available and have increased the general public's awareness of the importance of good nutrition.

There is cause for concern, however, regarding chronic degenerative diseases such as cancer, heart disease, and osteoporosis. There is reason to believe that such diseases are affected by both diet and heredity. Biotechnology researchers are also concerned with the effects of the climate and soil conditions on the food supply. A problem with the food supply can result in problems related to diet and nutrition.

Researchers have studied the human body and its nutritional needs for many years. The United States Department of Agriculture and Department of Health and Human Services both allocate millions of dollars annually to nutrition research. Experiments cover a wide range of nutrition concerns. The science of nutrition and its relation to health and disease prevention continues to be a field with many unanswered questions.

The Scientific Method

The **scientific method** is a means of solving problems scientifically; it is a methodical process of controlling and manipulating variables while adhering to scientific standards of attitude and behavior. However, actual steps in the scientific method may vary. Generally,

the scientific method includes the following steps:

1. Identify the problem and state it clearly as a question.
2. Gather information by such means as reading, interviewing, observing, and surveying.
3. Form a **hypothesis**, or possible answer to the problem, based on information gathered through research or observation.
4. Test the hypothesis through experiments or carefully recorded and classified observations.
5. Draw conclusions based on results.

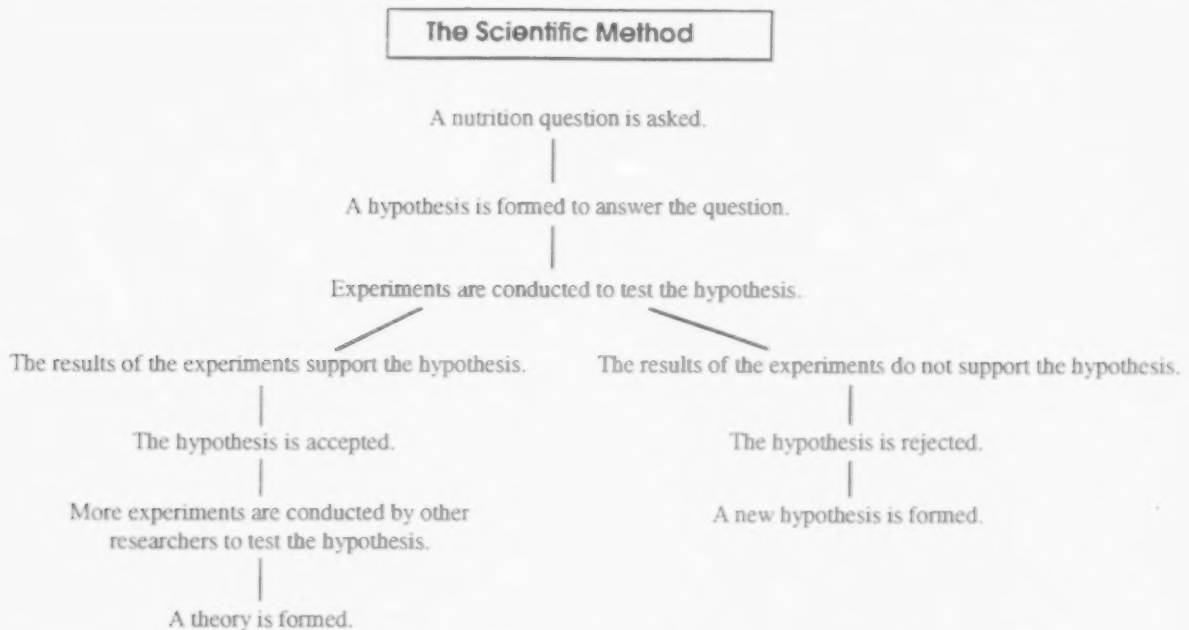
See Figure 18.1 for a diagram of the scientific method.



Research

Merriam Webster's Collegiate Dictionary defines research as the collection of information about a particular subject and investigation or experimentation aimed at the discovery and interpretation of facts. More simply stated, **research** is the application of the scientific method to the study of problems. The steps involved in conducting research are shown in Figure 18.2.

Observations are effective means of gathering information. Observations should be accurate, precise, and recorded in an organized format. The use of instruments such as microscopes, rulers, cameras, or magnifying glasses can increase the accuracy of sensory observations. After a nutrition or food science question is posed, the issue is identified. **Interpretations** are conclusions that are based on



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⇒ **Figure 18.1**

Steps in Conducting Research

1. The selection and definition of a problem (a nutrition question is asked).
2. The execution of research procedures (the gathering of information and collection of data through observations, classification of data, experiments, surveys, and interviews).
3. The analysis of data (the use of information gathered to try to answer the research question or questions).
4. The stating of conclusions (the compilation of findings).

⇒ **Figure 18.2**

observations. The validity of interpretations is increased when the interpretations are supported by multiple observations. Many probing questions can surround a food science or nutrition research topic. Figure 18.3 gives examples of probing questions.

Research Questions

- What prior research has been done?
- What were the findings?
- What conclusions can be drawn from the findings?
- What future research is planned?
- Who can benefit from this information?
- So what? Who is affected by this research?
- Is there other research that supports these findings?

Figure 18.3

Attitudes central to research and scientific inquiry include honesty, objectivity, openness, skepticism, questioning, accuracy, carefulness, and unbiased evaluation. Regardless of the selected project focus, it is important to recognize and understand the importance of these attitudes and characteristics to the success of any investigative study.

Essential Questions: Research in Nutrition, Food Science, and Food Technology

1. What are five key steps in the scientific method? Give an example applicable to food science.
2. What are some characteristics of scientific research?
3. Why is research important?

CHOOSING A RESEARCH TOPIC

Food scientists research many topics and then decide which issues or interests are important for the investment of time and funding. The first criteria for choosing a research topic is most often a need to find a solution to the problem or answer to the question. Food scientists and food researchers determine topics to research in numerous ways. Public health needs, solutions to problems in the food supply or in food production, or issues involving food safety and sanitation often serve as springboards to food science research.

Resources such as public libraries, professionals in the food science field, classroom textbooks, and the Internet are places for students to search for an interesting topic for classroom research. Local universities offer information on topics of interest to the government or have information on a community problem in food and nutrition that needs research to aid in finding a solution.

After a research topic is selected, it is necessary to choose a specific area of focus. Time limits, funding, and available resources often narrow the topic for the researcher.

Regardless of the source of the research topic, the researcher then must commit to utilizing all available resources to solve the problem or answer the research questions. Figure 18.4 and 18.5 highlight possible resources and areas to consider before starting a research project.

Resource List for Research Project

- How much time will the project need?
- What equipment is needed to conduct research?
- What supplies are required?
- Where and what kind of space is needed for recordkeeping?
- What background research is needed?

Figure 18.4

◆ Essential Questions: ◆ Choosing a Research Topic

1. What resources should be gathered before starting a research project?
2. What are considerations for choosing a research topic?

RESEARCH METHODS

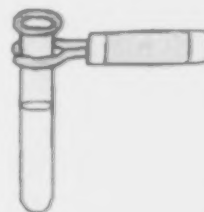
Current research studies in the field of food science and nutrition involve genetic engineering as well as nutrition studies. In the areas of nutrition, researchers continue to ask the following questions?

- Other than the key nutrients, what components in food support good health and the prevention of disease?
- Which nutrients are being adequately supplied by the American diet?

- Which nutrients are missing from the diet of most Americans?
- Why is there a difference between the nutrients people need and the foods they actually choose to eat?

Genes are the basic hereditary unit of all living things. Each gene has two parts. One part is known as the switch. The switch tells the gene when to turn on and off. The other part is known as the coding center. The coding center houses the genetic blueprint for the product of the gene. These blueprints are also known as chromosomes. **Chromosomes** carry the hereditary characteristics of an organism. The number of chromosomes is constant for each species. Abnormalities occur when there is an increase in the number of chromosomes. Research in the field of genetic engineering is developing ways to correct these abnormalities as well as strengthen the normal genes.

Genetic engineering is a process by which scientists manipulate genes by introducing small amounts of foreign chemicals into the genetic makeup of an organism. **Cytogenetics** refers to the manipulation of genetics at the level of chromosomes. The organism will then take on new characteristics. This process enables scientists to move genes from one organism to another that could not normally be crossed or mated.



Plant and Soil Science Studies

Genetic engineering can be used on plants to promote resistance to various diseases and pests. The plant used most often for plant research is the *Arabidopsis Thaliana*. This plant has a very simple genetic structure. Since this plant offers no agricultural benefits, experiments can be conducted first with this plant, then tried on agriculturally-beneficial plants.

Research Ideas	
Personal Needs	A relative is diagnosed with cancer and requires a special diet.
Societal Needs	Many American children are malnourished.
Government Needs	Astronauts need new space foods and the U.S. military requests additional MRE's (meals ready-to-eat with shelf life of ten years).
Community Needs	Local children have contracted a foodborne illness.
Industry Needs	Consumers demand more convenience food products.

➤ **Figure 18.5**

Other genetic engineering in plants aids in pest resistance and builds tolerances to diseases. Genetic engineering of plants can also build resistance to environmental stresses, such as heat and drought, that can have negative effects on plants.

Animal and Human Studies

Animals and humans are used in scientific studies to help understand nutrition and its impact on various illnesses and diseases. The research is conducted by highly qualified individuals through careful planning and approved methods. Food science research is conducted by the following professional groups:

- the food industry
- federal and state governments
- health professionals
- medical research facilities
- university nutrition and food science departments

At one time, there were few legal restrictions on the use of humans for medical research. It was not uncommon for scientists to conduct their experimental research on humans, often using mental patients and prisoners. Ethical concerns led to legislation

that restricted the use of humans for research purposes. Scientists now interpret data collected from animal research and translate the data to determine its effect on humans. Human subjects are typically used after data has been collected from the animal research and specific conclusions have been drawn. Then, human subjects may be used with their written consent.



In animal research, the type of research to be done determines the type of animal used. The budget also may influence the choice of animals because some animals are more expensive to purchase and care for than others. The size, temperature controls, and capabilities of the laboratory are other determining factors. A license is required for laboratories before any experimentation can begin. The type of license is determined by the size and capabilities of the facilities.

Some animals are more suited to a particular experiment than others. For example,

a rat should not be used in an experiment related to a vitamin C deficiency because vitamin C is not essential to the rat's diet. Rats do, however, need the B vitamins. This makes the rat a good participant in research related to the B vitamins. Guinea pigs need vitamin C in their diets, making them good candidates for research on vitamin C.

For research and development of antibodies, rabbits and goats are most useful. They have the capability to produce antibodies after being injected with antigens (toxins). This research is quite beneficial to studies related to fighting disease and infections in both humans and animals. Scientific research and biotechnology have also led to the ability to produce antibodies from cultures.

Monkeys are used in some experiments because they are the animals that are most closely related to man. The genetic makeup is very similar, making many research outcomes transferable to humans.

Mice are the preferred animal for laboratory experiments because they have a fast gestation (pregnancy) period and mature quickly. Rats often are used as well. In addition to their fast gestation period and rapid maturation, they also are inexpensive, require few laboratory capabilities, and are the least controversial animals for research. Rats and mice become good models for studying human health conditions such as cancer. Their quick maturation process enables researchers to determine results much sooner than with other animals.

Human subjects are typically used in scientific research after a similar study has been conducted on animals or in the laboratory through cultures. Even though a technique or method may be beneficial to an animal or laboratory culture, it may not necessarily be beneficial in the human body. Volunteer human subjects have been used quite often for cancer prevention, cure procedures, and medications. Human subjects also

have been used for AIDS prevention and experimental cures.

In the late sixties and early seventies, many people began to question the procedures used on some laboratory animals. Legislation was passed to establish guidelines for animal research to ensure that research methods used were ethical and did not cause the animal any unnecessary pain. Enforcement for the legislation is conducted by the United States Department of Agriculture (USDA). The legislation also called for committees to be established at each institution conducting any type of animal or human research. These committees are referred to as the Animal Care and Use Committee and the Human Subject Use Committee.

In a university or medical school situation, these committees must report to the institution's research services department or office. Before any research can be done at an institution, the researchers must inform the appropriate committee of its plans, procedures, and intended use of the information received. The committee must then approve or deny the research request. If the research request is approved, the committee must monitor the research from start to finish. The researcher also must keep the committee informed of the procedures and results. The USDA also makes several inspections of research facilities to identify possible violations. An annual report must be prepared by the appropriate committee regarding research it monitors. Reports are submitted to the USDA.

Evaluating Research

Most research articles follow a similar format in reporting details of the study and conclusions that were drawn based on the results. Basically, it is similar to the process individuals use in writing a theme. Most themes are written following a similar format although the topics vary widely. Such is the case with research articles. Although the topics vary from nutrition to the effects of television,

the method in which the research is reported in written form is very common and is the accepted practice among researchers.

Components of A Research Article

- **The abstract** - A very brief overview of the research article.
- **The Review of Literature** - A description of earlier research and up-to-date scientific knowledge on the topic.
- **The Methodology** - A definition of key terms, procedures used in conducting the study, and descriptions of the instruments used in conducting the research.
- **The Results** - A report of the findings of the study using tables and figures to organize and summarize the results so that the reader can more readily interpret the results.
- **The Conclusions** - A summary of conclusions based on results of the study, and additional questions and information that occurred as a result of the study.
- **The References** - A list of references and resources used in the study which should reflect a broad scope of knowledge and information on the research topic.

◆ Essential Questions: ◆ Research Methods

1. Why are mice and rats used primarily in nutrition research?
2. What is the process for using human subjects in research studies according to current legislation?

CURRENT ISSUES IN FOOD SCIENCE AND NUTRITION RESEARCH

Biotechnology accounts for many advances in agriculture, medicine, food processing, and nutrition. Biotechnology is the combination of engineering and technology to study and find solutions to problems of living organisms. These advances share a common goal of making more quality and nutritionally-efficient food available to consumers.

Agricultural advances include improved irrigation methods that allow otherwise useless land to produce crops. Other advances include new types of farming called aquaculture and hydroponics. Hybrids (the offspring of two unlike species) and other plant forms created through genetic engineering have improved the quality and yields of various plants. New strains of plants are being created through crossbreeding. Recombinant DNA and cell fusion, two methods of altering genetic makeup, have unlimited possibilities.

Research is being conducted to genetically manipulate rice plants in order to improve their root penetration. In long periods of drought, the rice plant must rely on its root system to reach deeper into the soil to get water. Without enough water, the plant will weaken or die. Improving the root system of the plant allows it to survive during times of drought. This research is called plant stress biotechnology research. It combines molecular biology, genetics, and soil physics.

Genetic engineering produced supercows (cows that can produce substantially greater amounts of milk than the average dairy cow) and superpigs (pigs that are much larger and produce more and leaner meat than the average pig) by transferring the knowledge learned from plant and soil science research to animal research. Future plants may be

totally immune to disease. Research is being conducted to enable plants to resist herbicides naturally.

Food technology has led to improvements in the methods and results of food processing. Food nutrification programs have emerged, making the food people eat more nutritious. At one time in the United States, iodine deficiency was a problem. Since 1924, iodine has been added to salt to eliminate iodine deficiency. In parts of South America, a vitamin A deficiency was discovered. Sugar was nutrified with vitamin A to help alleviate this dietary deficiency. Research continues to discover better ways to package and market food products.

Nutrition research and medical research have determined that diseases interfere with a person's ability to absorb essential nutrients. Current disease research and new forms of immunization have helped to eliminate some problems, but much more research is needed.

The field of food science and nutrition changes daily. Other issues in nutrition and food science not mentioned above include, but are not limited to, the following:

- the relationship between cholesterol and exercise
- the relationship between cholesterol and smoking, and cholesterol and alcohol consumption
- the relationship between nutrition and cancer
- the relationship between food additives and good health
- the relationship between exercise and nutrition
- the relationship between HIV and nutrition
- The relationship between health and high protein diets
- eating disorders
- growth hormones
- the relationship between illness and nutrition

Current issues today may be solved or understood tomorrow. Individuals can be assured that other issues will develop and keep researchers and scientists challenged for years to come.

Essential Questions: ♦
Current Issues in Food and Nutrition Research

1. What new developments in food science are the results of genetic engineering?
2. What are four current issues related to food science and nutrition research?
3. Why is nutrition and food science research important?





Chapter Highlights

- ☆ Researchers have studied the human body and its nutritional needs for many years. The science of nutrition and its relation to health and disease prevention continues to be a field with many unanswered questions.
- ☆ The scientific method is a means of solving problems scientifically; it is a methodical process of controlling and manipulating variables while adhering to scientific standards of attitude and behavior.
- ☆ Research is the application of the scientific method to the study of problems.
- ☆ Observations are effective means of gathering information. Interpretations are conclusions that are based on observations.
- ☆ Topics for research in food science, technology, and nutrition are chosen because of their relation to personal needs, personal interests, societal needs, government needs, community needs, and industry requests.
- ☆ Animals are used in many scientific studies to help increase understanding of nutrition and its impact on various illnesses and diseases.
- ☆ Legislation passed in the early 1970s established guidelines for animal research to ensure that research methods used were ethical and did not cause the animal any unnecessary pain. Enforcement of the legislation is conducted by the United States Department of Agriculture.
- ☆ Biotechnology is the combination of engineering and technology to study and find solutions to problems of living organisms. Biotechnology accounts for many advances in agriculture, medicine, food processing, and nutrition.

REFERENCES

- Bryant, C.A., Courtney, A., Markesbery, B.A., and DeWalt, K.M. (1985). *The Cultural Feast. An Introduction to Food and Society*. St Paul, Minnesota: West Publishing Co.
- Chmelynski-Caprione, C.A. (1992). *Opportunities in Food Service Careers*. Lincolnwood, Illinois: VGM Career Horizons.
- Felstehausen, G. (1999). *Managing Multiple Roles*. Lubbock, Texas: Texas Tech Home Economics Curriculum Center.
- (1994). *Handbook for Safe Food Service Management*. Englewood Cliffs, and New Jersey: National Assessment Institute.
- Kimbrell, G. and Vineyard, B.S. (1998). *Succeeding in the World of Work*. New York, New York: Glencoe McGraw-Hill.
- Kittler, P.G. (1998). *Food and Culture in America, A Nutrition Handbook*. Belmont, California: West/Wadsworth.
- Kowtaluk, H. and Kopan A.O. (1997). *Food for Today*. New York, New York: Glencoe McGraw-Hill.
- Largen, V. L. and Bence, D. L. (1996). *Guide to Good Food*. Tinley Park, Illinois: The Goodheart-Willcox, Inc.
- Larson-Duyff, R. (1998). *The American Dietetic Association's Complete Food & Nutrition Guide*. Minneapolis, Minnesota: Chronimed Publishing.
- Mehas, K.Y. and Rodgers, S.L. (1997). *Food Science, The Biochemistry of Food and Nutrition*. New York, New York: Glencoe McGraw-Hill.
- Potter, N.N. and Hotchiss, J.H. (1995). *Food Science*. New York, New York: Chapman & Hall.
- Spears, M.C. (2000). *Foodservice Organizations, A Managerial and Systems Approach*. Upper Saddle River, New Jersey: Prentice Hall.
- πWardlaw, G.M. and Insel, P.M. (1990). *Perspectives in Nutrition*. St. Louis, Missouri: Times Mirror/Mosby College Publishing.

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